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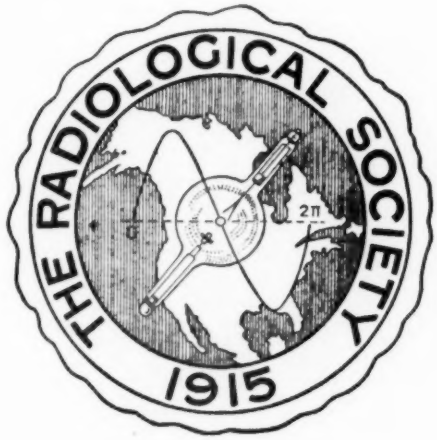

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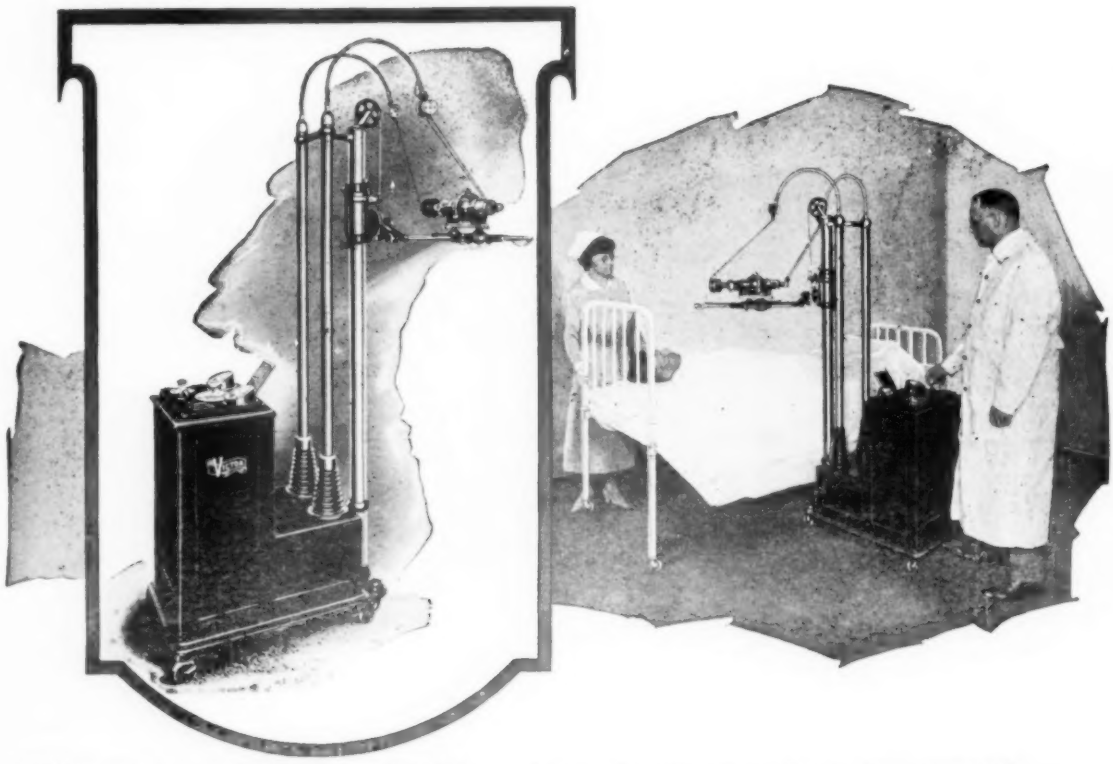

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Omaha, Nebraska
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Bone Diseases, Osteoporosis or Lipomasia from Fixation and Non-Use

JOSEPH COLT BLOODGOOD, M. D.
Baltimore, Maryland

I HAVE but three cases to report. However, as the first two were referred to me with a possible diagnosis of sarcoma, and the third with a diagnosis of tuberculosis, and as the first two patients have completely recovered after removal of the fixating dressing and forced function, and the third is rapidly showing improvement now only two weeks after the removal of the plaster cast, I feel that attention should be called to this group from the standpoint of differential diagnosis.

Case 1—(Pathol. No. 15895)—The x-ray plates in this case were sent to me by Dr. R. L. Ramey of El Paso, Texas, in 1914, eight years ago. These plates have been lost, but were practically identical with those shown in Figs. 1 and 2 from the second case.

Clinical History: Dr. Ramey wrote that the patient, an adult female, had been confined to her home for one year and had not even been out of the house for months. The pain in the joint was looked upon as rheumatic and she had been given antirheumatic medicine and Bier's hyperemia without improvement. After this long period of almost complete lack of fnuction, Dr. Ramey sent me the x-ray plates, and he was most impressed with the light shadows in the internal condyle. The patient remembered a distinct contusion of the knee nine months before the onset of pain. Later Dr. Ramey reported that the Wassermann was negative, the urine contained no Bence-Jones bodies; now and then the temperature rose to 100, and the Von Pirquet test gave a reaction. Then, on further questioning, the patient remembered that she had had trouble with this knee years before.

X-ray Report: I wrote Dr. Ramey as follows: "The x-ray picture is one of osteoporosis. This bone absorption giving the mottled lighter areas is present in the lower end of the femur, the upper end of the tibia, the fibula and the patella. There is no evidence of malignant disease. These bone changes are common near joints when, because of arthritis, the limb is not used." At that time I also wrote that tuberculosis might give such a picture, but as a rule we should be able to see, in addition to the diffuse osteoporosis, definite foci of bone destruction, due to the tubercular granulation tissue.

Today I would write that I have never seen tuberculosis give this picture. It is the usual picture observed in arthritis when there is fixation treatment and non-use.

Second X-ray: Five months later other x-ray pictures were sent. The patient in the meantime had improved under forced diet, massage and moderate use. I could not see any difference in these pictures. The patient gradually improved.

Result, May, 1922: The patient writes that her knee gives her practically no trouble and that she is using it in a normal way.

Case 2—(Pathol. No. 23881)—When I saw the plates in this case (Figs. 1 and 2) and examined the patient, referred to me by Dr. K. H. Beall, of Fort Worth, Texas, in December, 1918, I immediately remembered Dr. Ramey's case and compared the x-ray pictures which, for practical purposes, were identical. In the Journal of Radiology for March, 1920, Figure 22, I reproduced these pictures to illustrate the bone changes which may follow traumatic arthritis when fixation or non-use are continued too long, and described how this lesion could be differentiated from other types of benign and malignant lesions.

Clinical History: This patient, a white male, aged 46, in perfect health, received a severe injury to the left knee thirteen months ago. He stepped through a hole in the floor. The upper end of the tibia caught and he fell forward, twisting the knee. There was, therefore, both a contusion and a sprain, and he presented at once the typical picture of traumatic arthritis with effusion. An immediate x-ray showed no fracture, nor evidence of a pre-existing lesion. He has never recovered, although there have been periods of improvement, made worse by secondary slight sprains. The limb has been in a plaster cast, or the patient has walked on crutches ever since.

Examination: Nothing on inspection. Palpation showed no particular infiltration or thickening of tissues and no fluid in the joint. The knee was almost fixed in extension. There was some slight active and passive motion. This gave pain and joint crepitation. All other examinations were negative.

Although I was quite certain that the entire condition was the result of injury and non-use, the patient seemed unwilling to start active motion and massage until more was done to exclude a possible tuberculous lesion. Under novocain the lower end of the femur was explored through the external condyle; the cortical bone was thin, the cancellous bone porous with much fat, and here and there was blood pigment.

Microscopic Sections: The synovial membrane showed thickening with chronic inflammatory tissue. The bone presented the picture of osteoporosis; between the bone lamellae there was chiefly fat, here and there blood pigment, here and there round cells and some osteoblasts, no giant cells. The only evidence of the old trauma was the remaining blood pigment.

Treatment: I instructed the patient to use the limb, to gradually increase the weight-bearing and the function, to soak it twice a day in a hot bath, and to give massage.

Result: Improvement began at once. It was some time before he discarded the crutches and took to a cane.

X-ray One Year Later: The architecture is not yet restored to normal, but the bone is distinctly less porous than one year ago. The patient now walks with a cane. There is no limp, and pain and tenderness have almost disappeared. Result in 1922, practically well.

Case 3—(Pathol. No. 31024)—I saw this patient with Dr. Bombard in Burlington, Vermont, August 20, 1922. This healthy looking man aged 42, was sitting in a chair with the left limb in plaster and resting on a chair. This practically describes his condi-

Figs. 1 and 2—Case 2—Pathol. No. 23881—Diffuse osteoporosis (lipomasia). Bones of knee joint thirteen months after contusion with non-use during this interval.

Fig. 3—Case 3—Pathol. No. 31024—Lateral view of knee joint seven months after a sprain followed by fixation and non-use. Marked osteoporosis of all bones.

tion with intervals of improvement since a sprain of this joint seven months before. Dr. Bombard informed me that two consultants had looked upon the x-ray plates as rather indicative of either tuberculosis or some marked infectious arthritis. You will observe from Figures 3 and 4, the x-rays of the knee joint, that they are practically identical with those in Case 2; perhaps the osteoporosis is more marked. It involves all the bones in the neighborhood of the joint and is present to a lesser degree in the shaft, particularly marked in the patella.

A few days later we took an x-ray of the ankle on the same side in which there had been no clinical symptoms, but the same fixation, and we found the same x-ray evidence of osteoporosis.

In the x-ray pictures reproduced here, and in Case 1, there is no evidence of bone expansion, there is no new periosteal bone formation, simply the normal architecture of the bone is changed by a diffuse, irregular bone absorption.

The only condition that might simulate this would be multiple myeloma and metastatic carcinoma. But when I compare these plates with the x-ray plates of the latter two diseases, I have not a single picture in which the three bones of the knee are involved, or the diffuse involvement in the region of the ankle and foot. When I compare a single bone of the x-ray pictures of these three cases with x-ray pictures of multiple myeloma or metastatic carcinoma, I find somewhat similar pictures in metastatic carcinoma in the pelvis, especially in the ilium, but as a rule in metastatic carcinoma and in multiple myeloma, the lighter shadows are larger.

In the first two cases we can exclude multiple myeloma and metastatic carcinoma; in the second, I think, the evidence excludes tuberculosis, and I am inclined to the view that in the third case the bone lesions are best explained as osteoporosis from non-use.

The examination in this case was identical with the second case. There was practically no motion in the joint, the patella was movable.

Treatment: This was the same as in Case 2, and there was rapid improvement within one week.

Conclusions

These three cases illustrate the importance of familiarizing ourselves with the x-ray changes in bone following non-use consequent upon injury or disease. Years ago Wolff established the fact that the normal architecture of bone and the growth of bone depended upon function, whether that be weight-bearing or not. If the lower jaw is

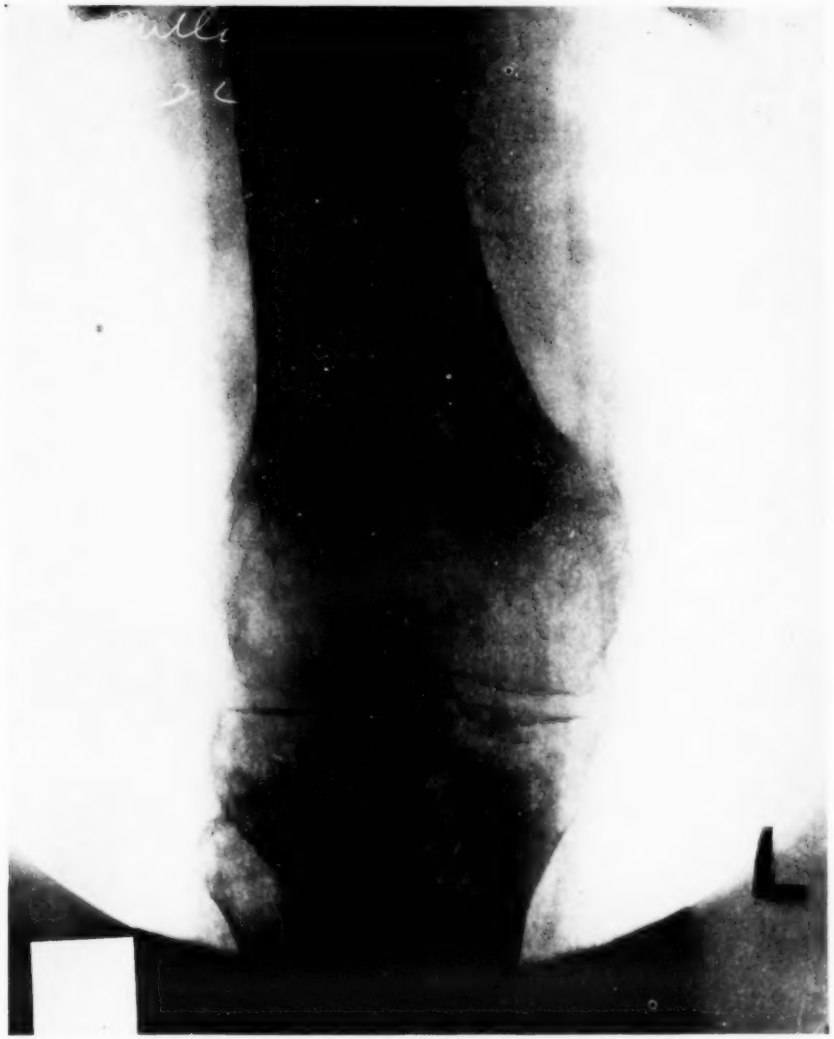

Fig. 4—Case 3—Pathol. No. 31024—Anteroposterior view of knee joint seven months after a sprain followed by fixation and non-use. Marked osteoporosis of all bones.

Fig. 5—Case 3—Pathol. No. 31024—X-ray, lateral view, of ankle, showing the same changes of osteoporosis present in the knee. (See Figs. 3 and 4.)

ankylosed in a child it does not grow, and the x-rays show osteoporosis.

As an example of the softening of bone due to non-use I remember some ten years ago exploring an ununited fracture of the femur due to overriding. Excessive callus was revealed in the x-ray plate and upon palpation. The patient had been in plaster for over nine months and had borne no weight on the limb. When I exposed the fracture the callus and the shaft of the bone itself were as soft as cheese and could be cut with the knife. The wound was closed. The patient was made to walk on crutches bearing weight on the limb for three months, and during this time massage was given. At the second operation the structure of the bone had been restored to normal and a saw had to be employed to cut it.

Some twenty-five years ago I remember assisting at a resection of a knee-joint upon diagnosis of tuberculosis in an apparently healthy woman of 65. The joint trouble had followed an injury and as it did not improve from rest in bed and fixation, it was diagnosed tuberculosis. At the operation no evidence of tuberculosis of the joint was found, and the bone was soft, the cortex thin. I still have the tissue and the sections of this case, and no evidence of tuberculosis can be found, only lipomasia. I remember distinctly how slowly bony union followed the resection. It was not until we had fixed the limb in an old Thomas' splint and got the patient up on crutches and encouraged weight-bearing, that solid bony union took place. This patient lived to a ripe old age with the discomfort of a stiff knee. Today I am of the opinion that she belongs in this group, and I am rather inclined to the view, when we come to restudy our old cases of resection of joints on the diagnosis of tuberculosis, there will be found a few more of this type.

In the December number of Progressive Medicine from 1899 to 1918, in reviewing the literature on fractures, I constantly called attention to those authors who wisely urged ambulant treatment and the maintenance of joint function and weight-bearing.

These cases also show the importance of x-ray of bones other than those immediately involved. In cases of the kind discussed here all the bones of the extremity in fixation should be x-rayed.

Cancer---Its Character and Causes*

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St. Louis, Mo.

THANKS to the application of many investigators the work accomplished in the study of cancer within the last twenty years has been very great indeed. This period may justly be called the experimental epoch in this study and today we begin to see that we have learned perhaps the most essential facts about the causes and character of cancer although many mysteries still remain. This is not peculiar to cancer alone, but applies to many other diseases as well.

In the short time at my disposal I can only attempt a very brief discussion of what I consider the most important conclusions arrived at regarding the character and causes of cancer. You will forbear with me if I shall omit a detailed consideration of the underlying facts and of much else that might be stated if the time permitted. I shall, however, make a special effort to indicate where uncertainties still exist, and to indicate also where is the actual borderline of our knowledge.

Cancer cells are cells which originally were normal cells of an embryonal or adult organism and which have become transformed into abnormal cells under the influence of various kinds of internal and external conditions. These cells act as if they were constantly stimulated to multiply and to move. Increased intensity of multiplication and of movement are in themselves not rarely found in other conditions than cancer. Indeed, it is an interesting fact that in general a stimulus which has the tendency to cause an increase in one of these two effects, multiplication and movement, likewise causes an increase in the other, although different kinds of cells show a varying degree of ability to respond with either multiplication or movement. But it is this increased tendency to multiply and move which causes the essential symptoms of the disease, which determines the recurrences, the metastases, the pressure effects and ulceration. There remain possibly some chemical effects which are at present not yet well understood and which may lead to an early cachexia.

Now, increased cell multiplication and increased motor activity as such are not peculiar to cancer; we find them in various other conditions, such as embryonic development, regenerative processes, in compensatory hypertrophy and what in general we may call correlative growth, in the formation of normal placentae and of the experimental placentomata. Even in regenerative processes an invasion of the blood vessels by the multiplying cells may occur. But cancer differs from these processes in one or two essential respects. In cancer this increase in the multiplying and motor reactions is permanent; in the other conditions it is limited, transitory, and the reaction leads to the elimination of the cause of the stimulus which induced the changes; in cancer the reaction does not have such a limitation. The stimulus acts unceasingly and unendingly; and while in other conditions the stimulus, being limited and regulated in its varying intensity and in the way it affects various tissues, leads to an orderly, well determinated reaction which remains in bounds and serves the organism, in cancer the stimulus affects one or more tissues disproportionately and irregularly; thus the normal interaction with neighboring tissues is disturbed and the growth becomes irregular. This irregular, unending increase in multiplying and motor activity is the essential characteristic of cancer.

It is very probable that the majority of the other characteristics of cancer are merely secondary to this primary condition. This applies especially to the abnormalities in morphological properties, the abnormal and varying size and general conditions of cells and nuclei, the relative lack of functional activity of the cells and the relative independence of the cancer cells from the normal regulative influence of a neural character or of some hormone. Quite generally in biology we find an antagonism between specific function of cells on the one hand, and multiplication and motor activity on the other. Thus what is often called the autonomy of cancer cells may be merely a secondary phenomenon. As to the irregularities found in mitotic nuclear division in cancer, it remains still to be determined how far this is likewise merely a secondary effect and how far it is primary. The preponderance of the evidence seems to point to the conclusion that it also is a secondary phenomenon.

We may then conclude that cancer cells are transformed normal cells functioning abnormally under the influence of a change which occurred as the result of certain conditions which we shall discuss presently, after we have briefly referred to some interesting properties of cancer cells and inquired whether they are distinctive of cancer cells or characteristics of tissue cells in general. To name a few of the more important characteristics:

(1) Continued transplantation of cancer cells has shown that they are potentially immortal. But instead of assuming that they therein differ from ordinary tissue cells, we must on the contrary conclude that, inasmuch as the majority of tissue cells may be converted into cancer cells, ordinary tissue cells as such are potentially immortal. This necessary conclusion I expressed in accordance with our experimental results more than twenty years ago, and recent experiments with tissue cultures by Carrel are confirmatory of this conclusion. It is well to emphasize that cancer cells differ from tissue cells not in being to a less degree potentially immortal, but in being continually dividing and moving with greater intensity.

(2) The growth of cancer cells can be experimentally increased and decreased. The same holds good in the case of normal tissue cells and there exists a state intermediate between cell death and active vigorous life.

(3) Cancer cells can be actively immunized against certain agencies tending to depress their proliferative activity and this property is transmitted through somatic heredity to succeeding cell generations. While I am not aware that this has been demonstrated in the case of tissue cells, I think it very probable that it, too, is not peculiar to cancer cells, but is a property of tissues in general.

(4) It has been maintained by Bashford that rhythms in growth exist in cancer tissue. This certainly does not apply to all cancer tissue; if such rhythms should exist, they would be comparable to the rhythms observed in the life of certain unicellular organisms.

We see, then, that so far there is no reason to attribute any peculiar property to cancer cells except the one already mentioned, namely, the increase in proliferative and motor energy leading to disorganized growth, lacking those regulative nervous influences, or those of some hormone, which are active in the case of many normal, less actively growing tissues. This change is potentially continuous and not temporary, as in related conditions to which we referred.

*—Read at the Midyear Meeting of The Radiological Society of North America, St. Louis, May 19, 1922.

How does this change come about? Under what conditions do normal cells become transformed into cancer cells? We have stated above that cancer, on the one hand, and regenerative, correlative, embryonic and placentomatous growth, on the other hand, are similar, inasmuch as in all these conditions there is an increase in proliferative, and also in motor activity under certain conditions, but that while in the former the change is continuous, in the latter it is transitory.

Now, it is an interesting fact that all those states which cause such a transitory growth may under certain conditions produce that change in the cells which makes them continue in this increased activity, although the direct cause of the increased activity has apparently ceased to exist; in other words, they convert them into cancer cells. Thus we find that all conditions which lead to long continued regeneration or related states, which produce, through mechanical, physical or chemical stimulation, cell proliferation and which continue over a relatively long period of time, may cause this transformation. Such stimuli may be physical, leading to continuous regenerative growth, and this is a frequent source of cancer especially of the mouth, cheek or skin, probably also of the stomach and uterus. The cancers caused by roentgen rays belong to this category. Or the stimulus may be chemical. Of this kind are probably the sarcomata and carcinomata produced in the liver or stomach of rats through the presence of parasitic worms. In other cases, as in the cancers caused by the use of tar or aniline dyes, it is difficult to decide how much of the stimulative effect is to be attributed to physical and how much to chemical stimulation.

Through application of such stimuli it has been possible, especially in the hands of Fibiger, Yamagiwa and Tsutsui, to produce cancer at will in rats, rabbits and mice in a very large number of animals. Fibiger produced cancer of the stomach in both rats and mice through feeding the nematode Spiroptera neoplastica (Gongylonema neoplasticum). Yamagiwa and Ishikawa, through the long continued application of tar, produced cancer of the skin in rabbits, and the same results were obtained with greater ease in mice by Tsutsui, Fibiger, Murray and Woglom, Bloch and Dreifuss, Bierich and Moeller. Yamagiwa and his collaborators through long continued injection of tar into the breast of a rabbit produced a sarcoma of the mammary gland, and in chickens in several cases he produced carcinoma of the oviduct through injection of a solution of scarlet red in oil. By various steps a transformation of normal tissue into cancer tissue occurs. The cestode sarcomata in the liver of rats which originate in the capsule around the parasite were observed not only in spontaneously infected animals, but also produced at will in a large percentage of rats by Bullock and Curtiss by feeding these animals the parasites. Marie and his collaborators succeeded through the long continued application of roentgen rays in experimentally producing sarcomata in rats. In general, we can say that carcinoma and sarcoma are both produced by the same kind of stimuli, and that their mode of origin is of a similar character. To this class of cancers, which are produced through the local effect of chemical stimulus, belong probably also the contact combination cancers, carcinomata or sarcomata, produced in normal tissues through stimuli emanating from a neighboring cancer. They have their analogy in normal tissue in the effect exerted, for instance, by the ovum on the granulosa of the follicle and thus on the whole ovary, in the effect exerted by the lens of the eye on the overlying ectoderm, and similar other correlations.

The stimuli which we have considered so far are of local origin. There are in addition other stimuli of a chemical nature which act at a distance. In normal tissues they cause the correlative growth of compensatory hyypertrophy, which also includes the hormonic growth as exemplified in the cyclic proliferative changes in mammary gland and uterus, in the development of deciduomata and placentomata, although other factors have to cooperate in the latter kind of growth processes. The same kind of stimuli are also concerned in the origin of cancer. One of the best studied varieties of cancer, the cancer of the breast in mice, originates only with the cooperation of an internal secretion emanating from the ovary and reaching the mammary gland. Early extirpation of the ovary in a sexually matured mouse prevents the development of mammary cancer at a later date. In this case a chemical stimulus originating in a distant organ takes the place of a chemical or physical contact stimulus.

During embryonal development the proliferative and motor activity of cells is at a higher level than in the adult organism. We find accordingly an important class of cancers originating in embryonic tissues. These cancers find their benign prototype in embryomata developing parthenogenetically from ova, and in displaced tissues and excess formations due to a localized unequal slowing down of embryonic development or other embryonic interferences. These pathological structures representing tissues with a potentially heightened growth energy, form a favorable soil for the development of cancers.

We see, then, that a condition, either actual or potential, of intensified growth brought about through the action of special stimuli or through the normal state of the tissues is one of the important factors in the origin of cancer. Tissues which normally are no longer able to proliferate do not produce cancers. On the other hand, organisms which have a very extensive power to respond with regulative growth processes to various growth stimuli show organ formation or agamic reproduction rather than cancer. Thus I would interpret the fact that in certain classes of invertebrates cancerous processes have not yet been observed to occur.

But the conditions which we mentioned as the causes of cancer are as such often impotent to cause it, if they act as separate entities. Very often they act in association with an hereditary constitutional factor, which determines the readiness with which the other factors which we mentioned are able to cause the cancerous transformation. This hereditary condition not only very often determines, whether or not cancer shall appear, but also as our investigations showed, at what age cancer shall appear, and, according to the important investigations of Miss Slye, which organs shall show this cancerous transformation. Statistical studies and observations of Tyzzer, Murray and myself made very probable the existence of this hereditary factor. In conjunction with Miss Lathrop we showed subsequently that many families and strains of mice kept under identical conditions differ greatly in their cancer rate, and that this characteristic cancer rate is transmitted hereditarily through successive generations. Miss Slye obtained similar results and greatly extended this field of investigation. I do not need to enter into a detailed discussion of this factor, inasmuch as it will be considered separately by Miss Slye. I may only say that while there seems to be some difference in the interpretation of the phenomena of heredity between Miss Slye and ourselves, in the most essential aspects we are all agreed. Differences which may exist are due to the complexity of the factors which enter into these investigations; they concern not the fact of inheritance, but the mode of inheritance, whether cancer is dependent upon the presence of a single recessive factor, or whether it is due, as appears more probable to us, to the action of multiple factors.

I wish, however, to refer to the relation which exists between the external and the inner, the constitutional, fac-

tors. There seems to be a quantitative relation between these two sets of factors. The constitutional factors vary in quantity in different families; some have in the average of the individuals a maximum quantity, other almost none. The majority have various intermediate quantities. Now, with a given stimulus of a low or medium intensity the presence of the constitutional factor seems to be a prerequisite for the development of cancer. On the other hand, the stronger the stimulus becomes, the greater are the chances that cancer will develop even without the presence of a large constitutional quantity. The constitutional factor may perhaps be dispensed with entirely.

Inasmuch as this interaction between stimulating factors and hereditary predisposition is of very great importance, and so far has hardly received any consideration, it might be well to add a few words concerning this point. The investigations which we mentioned above prove that a combination of two factors, namely, stimulation of cells through external or internal factors represents the essential cause of cancer. This statement is, however, not sufficient as it stands. In many cases these two sets of factors cooperate in the production of cancers; but there is sufficient reason for assuming that each of these factors separately is able to be a sufficient cause. The evidence on hand proves conclusively that external stimulation alone is able to produce cancer even without the presence of an hereditary predisposition. A very large number, perhaps the majority of the early roentgen operators who exposed their skin to the constant stimulative action of the rays, without using the necessary precaution, have succumbed to cancer of the skin. It is extremely improbable that in all of those cases there existed a special predisposition to cancer. If we turn to experimental tar cancer, I believe the results so far obtained justify the statement that it is possible to produce this kind of cancer in the large majority of mice subjected to the action of this substance. The percentage of cancers thus experimentally produced is extremely large in strains of mice so divergent as those used by Tsutsui in Japan, by Fibiger and Bang in Copenhagen, by Bierich and Moeller in Hamburg, by Murray and Woglom in England, and especially by Bloch and Dreifuss in Switzerland. We know that spontaneous cancer of the skin is extremely rare in mice; it is out of the question that in such a large variety of mice everywhere a special predisposition should have been in existence. The experiments of Fibiger and of Bullock and Curtiss, in which parasitic worms caused cancer in rats, while they point to a species, race or strain predisposition, likewise necessitate the interpretation that a sufficiently strong and long continued stimulus is in itself liable to produce cancer in a very large number of individuals having no special predisposition to acquire cancer of the stomach or liver. Through injection of tar into the mammary gland of a rabbit during a period of almost two years Yamagiwa, Suzuki and Murayama produced a sarcoma which was transplantable. Spontaneous sarcoma has not been observed so far in rabbits and it is extremely improbable that we had, in this case, to deal with a specific predisposition to sarcoma of the mammary gland.

We may safely conclude that a proper stimulus, if it acts over a sufficiently long period of time with the adequate intensity on animal tissues which are able to respond to single stimuli with regenerative growth processes, will produce cancer, carcinoma or sarcoma, even in the absence of an hereditary predisposition. But I believe the evidence on hand justifies also the converse statement, namely: If in an individual a sufficient amount of predisposition exists, cancer can be produced without the action of an extraneous stimulation. If we consider mammary cancer in mice, our own experiments, as well as those of Miss Slye, have shown that this cancer is transmitted in mice in families and strains on the whole in fixed percentages which are characteristic of each family and strain, and which are within very wide limits independent of the environment in which the animals live. Now, even in these cases our experiments showed that a stimulating factor is at work; but it is a factor which is acting within the animal organism and which is therefore hidden and can only be demonstrated through special experimental procedures. In the case of this stimulus it is only possible to diminish its strength in a graded manner, and correspondingly, quantitatively to diminish the incidence of cancer, and experimentally to alter the typical cancer rate; but it is not possible to increase the strength of this stimulating factor. We cannot increase the activity of the ovary, of the corpus luteum over a longer period of time, nor can we regularly accelerate ovulation. If that were possible we should have good reason to expect an increase in the incidence of mammary cancer in mice, with the same definiteness as it has been found in the case of cancer of the skin.

In the case of cancer of the breast the hidden internal stimulus forms a natural part in the functioning of the organism; yet it is not a prerequisite for the life of this organism and can be experimentally diminished or entirely eliminated. Nor is it conceivable that in other cases certain internal functions, which cannot be experimentally eliminated and which are necessary for our life, play the part which the functioning of the ovary plays in the case of mammary cancer. Then we would again have superimposed upon a specific hereditary predisposition a stimulus, but it would be a stimulus altogether hidden and not recognized as such and it would hardly be accessible to an experimental analysis. In this case the cancer would be the result of an hereditary predisposition in which a stimulus is not implicated in the etiology. For instance, certain hereditary tumor formations, which occur in Drosophila apparently with the same fixity as hereditarily transmitted normal characteristics, and the hereditary transmission of neurofibroma, gliosarcoma and certain other tumors in man, very strongly suggest the existence of this third type of combination in the etiology of cancer.

There still remains to be considered one important class of cancers, a class differing in several respects from the ordinary kinds of cancer and in which research has established the probability that a microorganism is the stimulus which directly causes the increase in growth and motor activity.

When we began our experiments in the propagation of tumors and transferred cancer to successive generations of animals by inoculating them with small particles of cancerous tissue, we not only intended to analyze the properties of cancer cells and the reaction of the animal body to the inoculated cells, but we also had hoped that we might be able to determine whether or not an agent could be separated from the cancer cell with which it would be possible to transfer the disease. We could indeed produce cancer by injecting material filtered through filter paper, by subjecting it to the influence of glycerine or certain other substances but we found that whenever our experiments had a positive result, living cancer cells as such had been transferred. Filtration through Berkefeld filters gave negative results. We concluded, therefore, that in the typical kinds of mammalian cancer it was not possible to separate an agent distinct from cancer cells. We found no indication that a microorganism was etiologically implicated. In accordance with this conclusion is the result of immunization experiments. Whenever immunization is accomplished, it merely consists in an immunity against the cancer cells. In principle, it therefore does not differ from the immunity against ordinary tissue cells.

While these experiments do not point to the etiological significance of a microorganism in the typical mammalian can-

cer, they are indeed a study in the etiology of tumors and I believe that the results obtained, although negative in character, are a contribution to the causative analysis of cancer.

The identical mode of experimentation extended to another kind of cancer, namely, certain sarcomata in fowl, on the other hand led to positive results, and Peyton Rous succeeded in finding some fundamental facts in this field. By means of filtration through filters impermeable to cancer cells proper, by drying out, an agent could be separated, the injection of which in other fowl caused the development of the typical sarcoma. In this respect both the sarcoma of fowl and the other cancers so far investigated differ. But they also seem to differ in certain other ways. In chicken sarcoma a passive immunity can be produced through the injection of material free from living cells. In mammalian cancer this has been found impossible to accomplish. Furthermore, according to Peyron, the injection of chicken sarcoma material into the muscle tissue of fowl causes a tumor of a different kind to originate, namely, a tumor consisting of muscle cells. In the typical mammalian cancer such an infection does not occur, except, if through the action of growing cancer cells extending over a certain period of time, a neighboring tissue of a different kind is stimulated to become cancerous. It is, however, not impossible that certain kinds of mammalian cancer are also due to a separable agent similar to the agent of chicken sarcoma. Thus, in sarcoma of the ear of hares, results have been obtained which are comparable with those found in the immunization of birds against chicken sarcoma.

Some observations might even be interpreted as favoring a similar conclusion in the case of the typical mammalian cancers. We know that mechanical irritation is one of the causes of cancer. Now, it has been found, in fowl, that mechanical injury of the tissue of the animal serving as host favors a development of sarcoma after injection of the cell free material containing the agent. But in this case we have to deal with a single trauma which evidently acts by removing a layer of endothelial cells which effectively separate the agent from the cells which otherwise it could not invade successfully. We might also refer to certain observations where injection of human cancer material into various species of animal caused peculiar new formations, which differed in character from the tumors used for inoculation.

We might further cite the experiments to which we have already referred in which contact with one kind of tumor incited normal neighboring tissue of a different kind to become cancerous. But we have seen that these observations are accessible to a different interpretation.

Taking all those facts together it is most probable that in certain cancers an agent separable from cells, probably a microorganism, supplies the constant source of energy which stimulates the cells to endlessly increased growth. In the majority of cases the combination of constitutional hereditary factors and stimulation of a variable character, extending over a certain period of time, causes a perpetual increase in the propagating and motor activity of cells characteristic of cancer. If later it should be found that even here microorganisms are implicated (an outcome which I consider not very probable) we would have to deal with a micro-organism present everywhere and in the real sense therefore not the specific cause of cancer. According to my judgment, the specific etiological factors in cancer have been established. They are certain definite constitutional factors acting together with physical and chemical stimulation, and among the latter we must include certain internal secretions.

Thus, we are now able not only to produce cancer experimentally at will, in any desired number, but we can also predict the number of cancers that will occur in certain families of animals, and moreover, we are able to reduce this number at will, experimentally, to any desired degree, or to prevent the appearance of these cancers altogether. Factors, which increase the growth energy of normal cells or tissues temporarily, if acting with a certain intensity over a long period of time, tend to raise the level of the growth energy and motor activity of the cells permanently, and thus to produce cancer.

One question still remains to be answered, namely, how do stimuli of various kinds lead to an increase in the multiplying and motor activity of the cells which in certain cases may be perpetual, although the stimulus has ceased to act? How can such an acquired characteristic become hereditary? These questions we cannot answer at present, any more than we can state what is the peculiar constitution of living matter which endows each kind of cell with a particular energy enabling and stimulating it to propagate, or to move, with a definite fixed intensity.

The further problems as to the causes of cancer merge more and more into the questions pertaining to cell multiplication in general. The further we penetrate, the more the study of cancer becomes a branch of the biology of cells and tissues. And the interaction between the study of cancer as a branch of biology and the other biological sciences is mutual. In the past the study of cancer has revealed fundamental properties of the normal cells and tissues and thus has materially contributed to general biology. In the future we may have to rely more on the contributions of sister sciences in biology in order to clear up the remaining problems of the origin of cancer.

Discussion

Maud Slye, Ph. D., *(Chicago)*: As my seat was so far at the rear I was unable to hear the paper presented by Dr. Loeb sufficiently well to be able to discuss it. One point came through, however, about which I might make a statement. That point was the inference which Dr. Loeb drew, that heredity might not be a universal factor in cancer occurrence, based upon the results in producing artificial tumors. In none of this work in artificial production of tumors has there been any previous analysis of stock in order to find out the natural tumor potentiality of the animals used. All of this work, therefore, leaves us uncertain of what part of the results was produced by nature, and what was the actual experimental residuum. Therefore, much of this artificial production of tumors will need to be tried over on biologically analyzed stock, whose natural tumor potentialities are known. The question of the relation between artificially produced tumors and spontaneous neoplasms has not, in my opinion, as yet been determined.

Dr. Leo Loeb (Closing): I had often thought that it would be desirable to test the effect of external factors in the production of cancer in making use of animals in which the hereditary tendency to a particular kind of cancer had previously been established. So far, I agree with Miss Slye. On the other hand, I do not agree with her view that external factors can only be active in individuals that have a high degree of hereditary tendency to cancer. On the contrary, I believe that if the intensity in the action of the external factors is regulated and the time during which it acts sufficiently prolonged cancer can be produced even in animals without hereditary predisposition or a relatively slight quality of it. The experiments made in animals in different countries, in which the percentage of positive results obtained is very high, and the experiences of man (roentgen ray workers), seem to me to be quite decisive in that respect. As I stated, a certain inverse ratio does probably exist between the amount of external or internal stimulation necessary and the amount of hereditary predisposition in cancer.

The Gall-Bladder*

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THE term "Gall-Bladder" when applied to roentgen diagnosis seems to be shrouded in mystery. So much so that it has been termed the romance of roentgenology. However, it is remarkable how today the roentgen diagnosis of a pathological gall-bladder is being so frequently substantiated at the operating table after the proper roentgen routine has been inaugurated.

Many articles have been written on the roentgen diagnosis of a pathological gall-bladder, but all of them advocating only partial methods until George in July, 1917, read a paper before the American Roentgen Ray Society on the roentgen findings of a pathological gall-bladder. No other substantial contribution was made to the literature until December, 1920, when Kirklin read a paper before this society substantiating George's findings. Both of the foregoing used every known roentgen method in arriving at their conclusions, including the use of the fluoroscope, an opaque meal and serial plates. In order to substantiate their findings I am contributing the results of my series of cases.

It seems that many men in reporting their findings report only on the basis of roentgenograms, and on the presence or absence of gall stone shadows. This is obviously in error, as the roentgen examination has not been concluded merely by taking plates or films. Gall stones have been classified into those containing calcium and those lacking this element. It is obvious that gall stones containing calcium can easily be shown, whereas if the stones are of the pure cholesterol type even the best plate made may not bring them out. Other evidence can well be considered at this point. Every patient submitted for gastro-intestinal examination is, or should be considered, a potential gall-bladder case. The patient must be properly prepared so as to eliminate, if possible, any shadow in the gall-bladder region due to gas or other intestinal contents. A series of double screen exposures are made of the right half of the abdomen changing the penetration of each one, so that the series will include, if possible, a set of films ranging from an under to an over penetration. Of course, if typical gall stone shadows appear then it is hardly necessary to do additional work.

Our routine, however, always includes the ingestion of an opaque meal and examining the patient under the fluoroscope for any further contributing evidence. The position of the stomach and duodenum is noted, special attention being paid to the mobility of the antrum and bulbus duodeni. Fixation of either one or the other, or both, with the stomach drawn to the right, with the bulbus duodeni under the right costal margin is at once highly suspicious of pericholecystic adhesions to the duodenum, provided both the stomach and duodenum are free from an organic defect. Care must be taken not to confuse the normal limited duodenal mobility of the hypersthenic type of patient, having a hypertonic stomach, with the pathological fixation due to pericholecystic adhesions.

Often, with or without fixation of the bulbus, the gall-bladder can be outlined by its pressure upon either the duodenum or stomach, producing an apparent defect. This can be readily differentiated from an organic lesion by the smoothness and concavity of the filling depression. Tender points are carefully noted so that they may be correlated to suspicious shadows on the roentgenograms. If possible, the patient is examined at twenty-four hours to determine whether or not the hepatic flexure is fixed in the gall-bladder area. This can also be done by the opaque enema, but care must be taken when this is done, that the findings of a high held hepatic flexure with a fully distended colon are not taken at face value. An increase of intracolonic pressure, due to the enema, plus the fixation of the colon by the mesentery is sufficient to hold the hepatic flexure up against the liver in many patients. Permitting the patient to evacuate, and re-examining the hepatic flexure, the release of the pressure upon evacuation would permit the flexure to drop down, if mobile. If pathologically fixed it will remain in its high held position under the costal arch.

By carefully noting the position and relation of the stomach and duodenum to the liver margin, also bearing in mind the tender points, one is now in a position to carefully consider the plates.

In our work, we have found one additional fluoroscopic sign that seems to be almost pathognomic of gall-bladder disease. This is a dilated duodenum with duodenal stasis, best viewed in the upright position. The barium shows this very clearly and easily. The entire duodenum can usually be outlined from the pylorus to the duodenojejunal angulation, with frequently a constant churning or to and fro movement in the second and third segments, the barium often being forced back into the bulbus. Kirklin described this as lagging. It is equally as important a sign as duodenal fixation, if not more so, as it has been observed in a considerable number of gall-bladder cases in which the duodenum was freely mobile. Incidentally, the feeling of fullness which is one of the very common complaints of patients afflicted with diseased gall-bladders, seems to appear simultaneously with the presence of the barium in the duodenum. This observation has only been noted recently, and at a later date we hope to have sufficient statistics to demonstrate this beyond all doubt. It is true that duodenal dilatation and stasis may occur in other conditions such as ulcer, obstruction, pathological appendix, colitis, etc., but these can usualy be ruled out quite easily.

As to the appearance of the gall-bladder on the serial plates, this does not conform with our usual conception as we see it on the operating table, as the appearance will depend upon the relation of the axis of the gall-bladder to the axis of the primary beams of x-ray projected on the plate. It may be pear shaped, round, ovoid, etc. It may lie anywhere between the diaphragm and the pelvis, over the spine, and to the right liver margin. We make no special attempt to look for stones, especially, as we have frequently missed stones found at operation, although having shown the gall-bladder outline on the plates. It is not necessary to show stones provided the gall-bladder itself can be seen. It is easier to demonstrate the pathological gall-bladder even with slight motion, due to breathing, than it is to demonstrate stones under the same conditions.

A satisfactory plate will show the liver outline, the kidney and the psoas magnus muscle. Any change in the gall-bladder, such as an increase in the density of the bile, the presence of stones, pericholecystic adhesions, thickening of the wall, etc., adds to the resistance of the gall-bladder to the x-ray so that it will cast a shadow denser than the normal. From our observations only pathological gall-bladders can be seen. I must qualify this, however, by noting that one case out of our series in which the gall-bladder outline was easily apparent was pro-

*—Read at Annual Meeting of The Radiological Society of North America, Chicago, Dec. 9, 1921.

nounced normal by the pathologist. At operation it was soft, easily compressible, and without adhesions. It may be that the normal gall-bladder can be shown, but if so, it is in such an extremely small percentage of cases that for all practical purposes it can safely be considered that it will not record a shadow on the roentgenogram.

Caldwell in 1915 called special attention to the proper lighting for the observation of gall-bladder plates. I do not believe he emphasized it strongly enough. In my experience the solution of the light problem has been one of the big contributing factors in the recognition of the pathological gall-bladder upon the radiogram. Too frequently it is the experience of every roentgenologist that after he has spent five or ten minutes in accommodating his eyes to the light with which he is observing gall-bladder plates, that he is called upon to demonstrate to some one who has just entered the room, the presence of a gall-bladder shadow. This individual's eyes have not been accommodated, making it impossible or difficult to see properly, and as the result he feels that the roentgenologist is "seeing things." If it is insisted upon that every one accommodate his eyes for the examination of gall-bladder plates just the same as for fluoroscopy, it will be easy to convince those who doubt it that a pathological gall-bladder shadow can be detected with or without the presence of stones.

This report covers a series of about 550 gastro-intestinal cases seen during the year 1921 up to the present date, not including an absence of three months while on an investigating tour of Germany. Regardless of the clinical findings, each case was considered as a potential gall-bladder case, no case being considered completely examined without having taken multiple double screen exposures of the gall-bladder region.

Total number gastro-intestinal cases examined, 550. Total number cases with roentgen evidence of gall-bladder, 101. Total number of these cases operated on, 47. Total number operated on with confirmation of roentgen findings, 40. Total number operated on and not confirming roentgen findings, 7. Percentage of correct diagnosis of those cases operated upon, 85.

These figures, of course, speak for themselves, yet they must be analyzed. Out of 101 cases with demonstrable roentgen evidence of a pathological gall-bladder only 47 were operated upon, so that it has been impossible up to the present to determine the percentage of correct diagnosis on the basis of all of the gall-bladder cases demonstrated by roentgen methods. Furthermore, I have no statistics available of those patients in whom no roentgen evidence of a gall-bladder was found, and of those patients who were operated upon. It is an extremely difficult matter to follow up every case in a city like ours where the patients move from one institution to another. Many of the operative cases are treated mechanically, but will eventually come to operation. It might be a matter of years before all of them could be accounted for. I do not wish it understood that I feel that the clinical findings should be disregarded entirely in favor of the roentgen diagnosis. The two should be correlated, for I am sure that many gall-bladder cases exist which have not been demonstrated by the x-ray. However, the roentgen findings alone, of a diseased gall-bladder, are in many cases conclusive evidence.

An analysis of the failures includes one case with a soft, compressible gall-bladder, which was removed and pronounced negative by the pathologist; one case of a suspicious shadow the size of an orange, which proved to be a carcinoma; in two cases the gall-bladder was adherent to the head of the pancreas in such a manner as to cause the duodenum to take a very wide outward swing to the right and these cases were diagnosed as carcinoma of the head of the pancreas; two cases of soft, compressible, non-adherent gall-bladders were not removed by the surgeon; they were merely palpated and pronounced normal. I personally do not believe any surgeon can by inspection and palpation determine whether a gall-bladder is pathological or not. Nevertheless, we have included these among our misses.

One interesting case showing the presence of a large, single, calcified gall stone had to be differentiated from a renal calculus. Fortunately the stone was dense enough to cast a shadow on the fluoroscopic screen. By lateral rotation it was easy to demonstrate that the stone lay farther anterior than posterior, making it easy to rule out the possibility of a renal calculus.

The salient points in the roentgen interpretation of a pathological gall-bladder can be based upon the following factors.

1. The definite visualization of the gall-bladder upon the plate, either with or without stones.

2. Local tenderness under the fluoroscope corresponding to the area of the shadow seen upon the plate.

3. Immobility of the duodenum providing the patient is not of the hypersthenic physical type, where normally it is held almost immobile. Very obese individuals increase the difficulties of satisfactory roentgenograms. The bulbus duodeni must be free from defect, although gall-bladder adhesions sometime cause an irregularity this is not the usual rule.

4. A high held immobile hepatic flexure fixed in close relation to the liver margin.

5. The presence of a gall-bladder seat in the normal bulbus duodeni or in the antrum.

6. Duodenal stasis and dilatation.

Conclusions

1. The pathological gall-bladder can be demonstrated roentgenologically in at least 85 per cent of all pathological gall-bladders.

2. A careful routine examination of the gall-bladder should be made in every gastro-intestinal case, each patient being considered a potential pathological gall-bladder case.

3. A careful roentgen study of the gall-bladder should be made in addition to every clinical examination, utilizing every roentgen method available.

4. The normal gall-bladder is so difficult to demonstrate on a roentgenogram that it can safely be considered that the normal gall-bladder does not show.

5. The roentgen evidence alone, in a high percentage of cases, is satisfactory evidence of a diseased gall-bladder.

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The Cecocolic Sphincteric Tract*

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IN MAN the term "cecum" is applied to that part of the colon which lies proximal to the entrance of the ileum. Its average length in the adult, measured vertically, varies from two and one-half inches to three and one-quarter inches. The size of the cecum varies in different animals.

In the fish there is no large bowel. In the absence of a colon, there is, of course, no bacterial digestion, because a colon with the production of gas would upset the stability of the gill breathing forms.

In birds (Fig. 2) there is a chamber—the cecal colon—into which the ileum empties through the ileocecal sphincter. Communicating with this chamber by a single opening are two long saccules, the ceca. The cecal colon communicates with a narrowed portion of the colon—the cecocolic sphincteric tract.

In the horse (Fig. 3) the cecum is a great culdesac, about four feet long, with a capacity of about seven to eight gallons. It is of conical shape. The body is attached dorsolaterally to the first part of the colon by the cecocolic fold. The ileum is inserted into the cecum on the mesial side. The cecocolic orifice is small in relation to the cecum and colon. It is a slit-like oval orifice and has a thick valvular fold at its ventral margin and is encircled by a muscular ring, the sphincter calci. It is a regular sphincter, not a tract. At its origin the colon shows a constructed neck (two to three inches in diameter), the cecocolic tract, which gives way to a dilated part or sacculation, called the "vestibulum coli" (Schmaltz).

In man (Fig. 4) and the carnivora the cecum reaches only a moderate development. The human cecum approaches the herbivorous type more than the carnivorous.

There appears to be a relationship between the size of the cecum and the perfection attained by gastric digestion, suggesting that there is a reciprocal relationship in function between the stomach and the cecum. In some genera, Keith points out, the stomach, in other genera, the caput coli, is the main organ of digestion. The caput coli (true cecum) corresponds to the stomach functionally, embryologically and anatomically. According to Keith, it holds the same relationship to the large bowel as the stomach does to the small bowel. He also indicates that there is an anatomical and functional correlation between the cecal colon and the cardia of the stomach.

In ruminants the ceca are relatively small, while in all those animals whose gastric digestion is imperfect, like the horse, the cecum is very large.

In mammalian ceca, as exemplified by the rat (Fig. 1), the cecum is, according to Keith, divided into three parts:

1. That portion which lies below or proximal to the ileocecal orifice, which is the true cecum or caput coli.
2. That portion of the cecum which lies above the ileocecal opening, which is the cecal colon.
3. The apical or appendicular portion of the cecum, which has a narrower lumen and thicker walls—the appendix.

The same three divisions exist in the human cecum, excepting that, whereas in the rat there is an additional sphincteric ring between the cecal colon and the cecum, which may be called the intercecal sphincter, in the human being this sphincter is represented by a vestigial strip of muscular fibers, the retinaculum (Fig. 4), which extends across the cecum, posterior to the lateral aspect of the gut and with which the two folds above and below the ileocecal opening merge. The cecal colon is considered to be that portion of the large intestine into which the ileum empties.

In birds, such as the ostrich, the cecal colon acts as a distributing chamber, the fluid part of the content being pressed through a sphincteried single opening in this atrium into the ceca (two long saccules), while the solid portions pass into the colon through a relatively long, contracted area, the cecocolic sphincteric tract. The true

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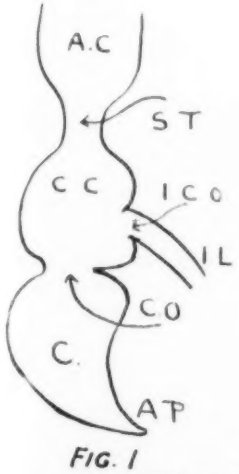

FIG. 1

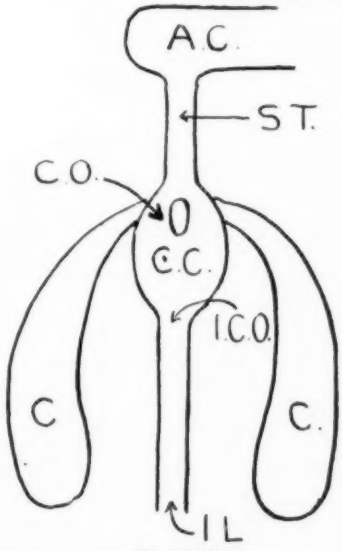

FIG. 2

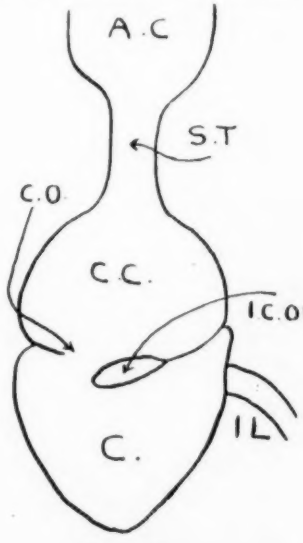

FIG. 3

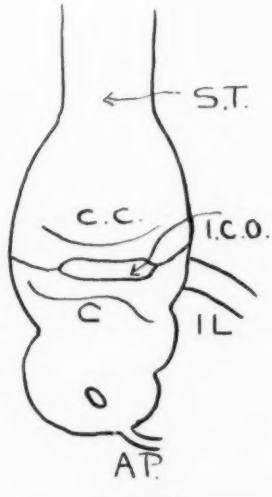

FIG. 4

Fig. 1—Ileocecal region of rat.

Fig. 2—Ileocecal region of vegetable-feeding birds. In the grouse the ceca together are twice the length of the small bowel.

Fig. 3—Ileocecal region of horse.

Fig. 4—Ileocecal region of human. The upper and lower folds, which meet at the ileocecal opening, forming the retinacula, are indicated.

CC—cecal colon.
ST—sphincteric tract.
C—caecum.
IL—ileum.
CO—intercecal opening.
ICO—ileocecal opening.
AP—appendix.

Fig. 5—Proximal colon, hardened in situ (Quain's Anatomy). F—cecal colon. E—ileocecal orifice. C—cecum. D—orifice of appendix. A—ileum. H—cecocolic sphincteric area.

cecum, therefore, is a chamber for prolonged digestion and absorption.

In the human being it is generally considered that the ascending colon begins just above the ileocecal orifice. A comparative anatomic study of the cecum would indicate that this is not a correct view, but that there exists above the cecal colon a sphincteric tract, which is imperfectly developed in human beings and functions in a greater or less degree, but is very well developed in air-breathing vertebrates, particularly those which live on a mixed or vegetable diet. Thus in the birds, the cecal colon is separated from the true ascending colon by a constricted area of narrow lumen (Fig. 2), well supplied with circular, longitudinal and muscular fibers, which acts as a sphincter, controlling the emptying of the contents of the cecum into the ascending colon and hepatic flexure and preventing the flow in the reverse direction, which takes place under the normal antiperistaltic movements characteristic of this portion of the colon.

Not only in birds, but in the horse, this sphincteric tract is well marked. In the animals the location of this area varies, depending upon the size of the colon. If the cecal colon is a long one, the area is located near the hepatic flexure. If a short one, it is situated in the more proximal portion of the gut. According to Keith, even when the cecum is absent, as in about twenty-five genera of mammals, the commencement of the colon is separated by the ileocecal sphincter from the ileum, on the one hand, and by a more or less demarcated cecocolic sphincter from the remainder of the colon, on the other. Between these sphincters is the cecal colon. The cecum is really developed from this portion of the colon, as an outgrowth.

It is not so generally appreciated that the sphincteric area may sometimes be well developed in man, as a reversion to type or atavistic remains. The site of this tract can, however, nearly always be demonstrated by vestigial morphological or physiological markings. It therefore must be considered as a factor in the physiological study of the cecum and ascending colon and in the consideration of the pathological conditions in this portion of the bowel. It opens in response to a chemical reflex from the cecum and appendix, just as the pylorus opens from a chemical sphincter from the duodenum, as will be discussed later.

The examination of the cadaver shows, in a proportion of cases, particularly when the intestines are hardened *in situ* (Fig. 5), between the gas-filled cecum and the true ascending colon an area, located from one and one-half to three inches above the ileocecal valve, which is firmly contracted and empty, in marked contrast to the gas-distended caput. This portion of the bowel appears to be in a state of tonic contraction.

In order to understand the regulating function of this cecocolic sphincteric area, it is necessary for us to consider the ileocecal sphincter.

According to Rutherford, the lower end of the ileum is controlled by a purely sphincter-like action of the circular intestinal muscle of the orifice. The musculature of the terminal part of the ileum extends for nearly four inches from the orifice.

The ileocecal outlet is controlled by strong, circular, muscular fibers, which, by their concentric contraction, keep the aperture closed till the condition of the contents, on one or the other side of the sphincter, initiates a reflex which relaxes the circular fibers, allowing the aperture to open and discharge more or less of the contents. This process may be assisted by the contraction of the longitudinal fibers.

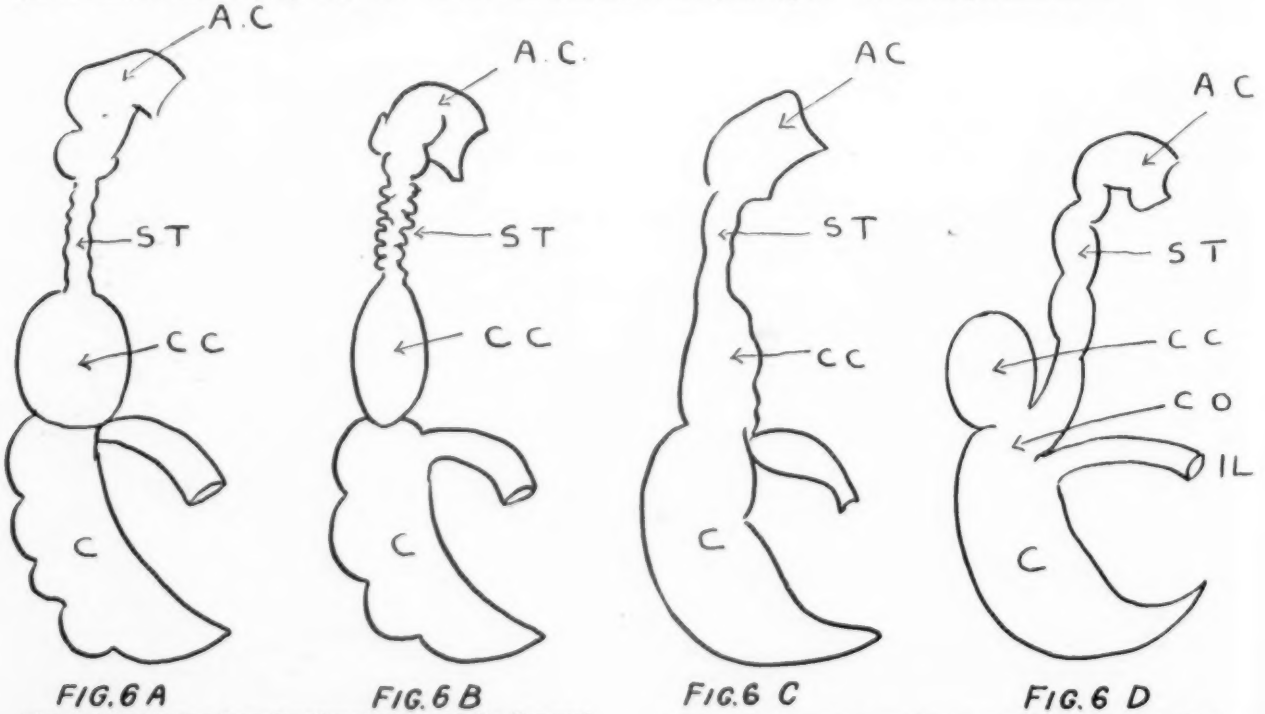

FIG. 6 A FIG. 6 B FIG. 6 C FIG. 6 D

Fig. 6—Illustrating four functional states of the ileocecal region of rats. In A and C the ileocecal sphincter is closed. In B and D it is open. In C and D it is open. Variations of the cecocolic sphincter are shown in A, B, C, D. (After Arthur Keith.)

Figure 5, taken from Quain's anatomy, shows the contracted commencing segment of the ascending colon in a specimen hardened *in situ*. The cecum, with its appendical opening, the cecal colon above the ileocecal orifice and the contracted portion above the cecal colon are shown in a specimen, intended to show the relations of the ileocecal orifice. The presence of this constricted area would explain the accumulation of gas in greater quantity than in the upper part of the ascending colon in a large percentage of persons. The entry of this gas into the ascending colon is impeded much in the same way as the sphincteric action of the terminal ileum prevents its egress into the ileum.

Through this sphincter, flatus and the semi-fluid contents of the ileum are discharged automatically, about a drachm at a time, at a rate depending on the degree of peristalsis. The semi-fluid contents thus discharged are churned about by a peculiar peristaltic activity into the cecum, so that the semi-fluid contents are inspissated and then pressed out of the pouches thus formed in the cecum, into the ascending colon through the sphincteric area, as pencil-like bodies which, being pressed together, form the characteristic lobulation observed in the feces.

The actual opening of the ileac valve seems to be the final part of a wave of peristalsis along the ileum. The peristalsis of the ileum ceases at the cecum. The cecal peristalsis is a movement peculiar to itself. The ascending colon peristalsis has its origin at the distal side of the cecocolic sphincteric tract.

The origin of the reflex controlling the sphincter at the ileocecal orifice and the cecal activity may be in a nerve center, located in the terminal ileum—the "pace maker" of Keith. The chemical stimulus from the mucous membrane of the cecum probably also plays a part in the regulation of the mechanism of the opening of the sphincter of the ileum and ejection of the contents of the ileum into the cecum.

In the cecocolic sphincteric tract there is the exhibition of a similar function, which serves the purpose of preventing the egress of the cecal contents into the ascending colon.

In the horse there is a mechanism by which the contents of the ileum may pass directly to the colon without entry into the cecum. This is true in most, if not all animals. The contents of the ileum pass into the cecal colon and not into the cecum. In the rodents and carnivora the content may pass some distance before antiperistalsis forces it back into the cecum. The cecal colon really acts as the antrum or distributing chamber. This anastaltic action in the cecocolic sphincteric tract is myogenic in origin, and tends to repel the cecal contents from the ascending colon until cecal digestion and absorption is complete.

The contraction and relaxation of the cecocolic sphincteric area is probably also regulated by chemical changes similar to those which regulate the opening and closing of the pyloric sphincter and the opening and closing of the ileocecal sphincter.

Thus it is known that the reaction of the chyme in the terminal ileum is acid, while the contents of the cecum are alkaline. [1] So, also, the reaction of the contents of the transverse colon differs from that of the contents of the cecum. The cecum is as sharply differentiated functionally from the ascending colon as the latter is from that portion of the transverse colon distal to the right one-third. [2]

The control of the sphincters is through the sympathetic nervous system, and stimulation through the inferior mesenteric plexus causes not only contraction of the various sphincters, but inhibition of peristalsis of the ileum and colon. The application of adrenalin produces the same inhibition here as in the stomach and pylorus.

Keith states that in the rat the action of the intercecal sphincter, which is undeveloped in man, and of the sphincter of the ileum are synchronized, when the latter is open, the intercecal sphincter is closed. (Fig. 6.)

A similar synchronism exists between the sphincter of the ileum and the cecocolic sphincteric tract. A disturbance between the synchronized action of these sphincters results in disturbed physiological action, which may be a factor in the production of organic disease.

Functional Disturbances

Spasm: The spasm of this cecocolic sphincteric area of the colon may take place with a marked distention of the caput coli and the retention of cecal contents. What role the spastic con-

Figs. 7, 8 and 9—Radiographs illustrating the position of the cecocolic sphincteric area.

traction of this portion of the colon plays in the production of cecal stasis with its attending systemic symptoms and the consequent production of adhesions about the cecum and appendicular disease is not within the scope of this paper. It is an important factor in the production of these conditions. Roentgen studies would indicate that there is undoubtedly a reciprocal relationship and a reciprocal activity not only between the ileocecal and cecocolic sphincters, but also between these sphincters and the pyloric sphincter. Gastric hyperperistalsis and hypermotility are usually associated with peristalic hyperactivity of the ileum and cecum. The sphincteric openings are concerned in this phenomenon.

It is conceivable that the entry of irritating content into the stomach with rapid pyloric evacuation of and rapid filling of the intestine, together with the quick arrival of this content at the ileocecal region and entry into the cecum might cause a spastic contraction of this cecocolic sphincter and lead to overdistension of the cecum. The sensation of pain would then appear as a result of this overdistension, for the pain sensation is due, not to contracture, but to increased tension on the bowel with muscular stretching. The overdistension would produce engorgement and on this fertile soil the bacteria would proceed with their roles in the production of appendicular and cecal inflammation. The cecocolic sphincteric area can be demonstrated in cases presenting the local symptoms of chronic appendical disease. The association of gastric hyperperistalsis, hypermotility and intestinal hypermotility with colonic and appendical retention is well known. The hypermotility leads to haustral spasm with spastic constitpation and cecal retention. Retention, in spite of hyperactivity, can only be explained on the basis of spasm of the cecocolic tract.

The roentgen examination of cases in which there has been a recurrence of symptoms, after the removal of the appendix, discloses in many cases the presence of a contracted portion of the colon, which corresponds to the site of the cecocolic sphincteric tract. We have demonstrated this on numerous occasions in the last three years.

Not only has this been demonstrated in our own cases, but it may be seen in the illustrations of others (See George & Leonard—"Pathological Gall-Bladder," Figures 252, 282, 287, 293, 331).

The roentgen examination has disclosed that this area is located at a distance of one and one-half to four inches from the entrance of the ileum into the cecum. Occasionally this contracted area has been noted more proximally to the hepatic flexure. Fluoroscopic palpation over this area elicits a sensitive pressure point. Manual pressure fails to obliterate this contraction. The area may be from one to two and one-half inches in length. It is frequently hidden in plate examinations by the haustra above and below it, but may usually be demonstrated in the ventrodorsal examination or by the administration of a small contrast enema. The ordinary examination by enema does not as a rule disclose it because of the overdistension which such a procedure produces. The administration of antispasmodics will not always cause a disappearance of this contraction, even though there results relaxation in the haustral formations. The changes characteristic of the spastic or dyskinetic form of constipation may be associated with this spastic contraction of the cecocolic sphincteric area. It is necessary to differentiate spasm of this sphincteric area from a distortion in the colonic form, which results from the presence of adhesions and from benign stenosis, in this region.

Organic Disease

It is pretty generally understood that areas of narrowing in the lumen of the gastro-intestinal tract are sites of predilection for organic disease. The portion of the colon corresponding to the site of the cecocolic sphincteric area appears to be a favorite site of ulceration, with fibrous stricture and pericolitis and of tuberculous and malignant disease.

This portion of the colon is only second to the pelvic colon in the order of frequency of involvement by disease.

The symptom complex of cecal stasis may be extrinsic and congenital in origin, as when it is due to Jack-

Fig. 8.

Fig. 9.

son's membrane or to an abnormal attachment of the omentum to the front of the cecum and ascending colon, or intrinsic in origin when due to an inflammatory thickening and sclerosis of the cecocolic sphincteric area. Pericolitis in this cecocolic region may result from a primary colitis or from a secondary infection due to cecal stasis, produced in both instances by extrinsic causes.

It would appear from the published records of malignant disease of the colon that carcinoma of the ascending colon is relatively rare, though the cecum is considered to be a very frequent site for malignancy.

Analysis of tumors of the colon, situated at a point distal to the ileocecal valve, which have been classed as cecal, will show when anatomical boundaries above described are recognized, that the majority of these tumors are really located in the sphincteric area.

The following factors must, according to Dr. P. D. Wilkie, be taken into consideration in the determination of the exact anatomical position of lesions which obstruct the lumen of the bowel in the region of the ascending colon: first, the variety of tumor, whether it is of the stenosing scirrhous type or of the fungoid, infiltrating type; second, the degree of obstruction produced by the lesion; third, the tendency of the disease to infiltrate and cause shrinkage of the wall of the gut; fourth, the competency or incompetency of the ileocecal valve. Thus a scirrhous carcinoma may involve only a ring of the bowel wall, producing very marked stenosis of the lumen, but if associated with a competent ileocecal valve, there may result such a dilatation of the cecum and cecal colon as to displace the growth upward and make it appear as if the growth were located close to the hepatic flexure, when it really has its origin at a much lower point. If the growth be of the infiltrating type with but little obstruction of the lumen, the shrinkage of the caput coli may be such as to make it appear that the lesion is at the level of the ileocecal valve when it really has its origin at a higher point, in the cecocolic sphincteric area.

If there is an incompetency of the ileocecal valve, there will be no displacement of the tumor-bearing area even though the tumor is of the scirrhous type, but the terminal ileum will undergo marked distension. There is, therefore, both comparative anatomic, physiologic and pathologic evidence which would speak for the existence of the cecocolic tract in man.

Summary

1. There is a proximal part of the colon in most herbivorous air-breathing vertebrates, which is normally in tonic contraction.

2. There is anatomic, physiologic and radiographic evidence pointing to the existence of a similar region in the human colon.

3. This cecocolic sphincteric portion of the colon exhibits an active repulsion of the intestinal contents, until such time as cecal digestion and absorption are complete.

4. The contraction and relaxation of this portion of the bowel is undoubtedly regulated by chemical changes in a manner similar to the control of the pyloric opening and closing.

5. This sphincter may be thrown into spasm with the production of cecal distension and stasis and thus initiate inflammation.

6. The cause of the spastic condition is not always removed by appendectomy, for it may be demonstrated in cases in which there is a reappearance of symptoms after removal of the appendix.

7. The pathological lesions of the alimentary tract are more likely to occur at points at or just proximal to regions of anatomic or physiologic constriction or where there is a change in the nature of the lining epithelium as in the esophagus, the cardia and pylorus. The cecocolic sphincteric colon may be considered to be one of these areas.

Footnotes

(1) The mucous membrane of the cecum is supposed to secrete a viscid alkaline fluid.

(2) There is both anatomic and radiographic evidence of the existence of a tract similar to the cecocolic tract in the right half of the transverse colon, a short distance from the hepatic flexure. This is the division point between the proximal and distal portions of the colon, the functions of which differ.

Roentgen Ray Anthropometry--(The Skull)

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Prognathism

PRICHARD designated under the term of prognathism one of those three forms of heads in which the length or prominence of the jaws is a characteristic feature to be observed among inferior African and Australian savage peoples. Later Retzius used the word orthognathy to signify a meaning opposite to prognathism. The profile of the face is virtually always oblique and the jaws protrude beyond the vertical line drawn from the glabella or nasion. Since all faces extend beyond this vertical plane orthognathism and opisthognathism are reduced to relative significance and mean, therefore, minor degrees of prognathism. According to Topinard, prognathism expresses the inclination of various lines made by certain facial planes with the horizontal.

Topinard early directed attention to a division of the study of prognathism from three viewpoints which he separately describes under the titles "prognathisme facial superieur" "prognathisme maxillaire superieur" and "prognathisme alveolo-sous-nasal." The method of determining the various degrees of prognathia for each of these types is that of the double square as elaborated by Topinard and Broca. The question of prognathism bears intimately on that of the facial angle as propounded by Camper; and there are two general methods for the estimation of this index. Using the nasion, the alveolar point, and the gnathion, lines are drawn to the basion and the two angles included between these three lines express one form of prognathic interpretation. The second general method consists in connecting the points mentioned with each other, and measuring the angular deviation from a horizontal plane. This latter method, it is thought, more truly expresses prognathia than the former. The topic will be more fully discussed in the next section of this thesis, where the general consideration of measurements is presented.

SECTION B—METRIC

Catalogue of Landmarks

Before describing the methods for measuring as they obtain in this system of roentgen ray anthropometry, it is essential that certain established anthropologic landmarks be identified on the roentgenogram of the skull. The more usually used landmarks, as gathered from Topinard, Martin, Cunningham, Hrdlicka and modern texts on anatomy, will first be presented and their definitions supplemented; and after these, certain new points of the endocranium that have never before been propounded, but that form useful adjuvants, will be described.

Alveolar Point—This is defined by Topinard as the most anterior point at the inferior extremity of the alveolar process of the upper jaw. Broca defined it as the lower extremity of the intermaxillary suture. Hrdlicka defines it as the lowest point of the upper alveolar arch between the median incisors. On the roentgenogram it is defined as the point included at the juncture of the alveolar process and the surface of the median incisors. At this junction the roentgenogram generally reveals a small notch which coincides quite accurately with the alveolar point as described by Hrdlicka.

Asterion—The point of meeting of the temporo-parietal, temporo-occipital and lambdoid sutures. It is seldom revealed on the roentgenogram and requires no consideration in connection with roentgen ray anthropometry.

Basion—The middle of the anterior margin of the foramen magnum. In median sagittal view of the skull, in the living, the basion is not roentgenographically revealed. In place of the basion the uppermost point of the silhouette of the ovoid external auditory meatus is used for purposes of roentgen ray anthropometry.

Bregma—The point of junction of the coronal and sagittal sutures. In the majority of roentgenograms this point is quickly recognized; in others it must be sought by extending the hair-line silhouette of the suture to the external table of the vault. In every case the exact location of the bregma can be visualized or judged.

Dacryon—The point of junction of the lachrymo-maxillary, fronto-maxillary and fronto-lachrymal sutures. It is of little significance to the roentgenologist.

Glabella—A point midway between the two supraorbital ridges. It is identified on the roentgenogram as that portion of the frontal sinuses that bulges most anteriorly above the silhouette of the orbital roof.

Gonion—Point of the angle formed by the ascending branch with the body of the lower jaw. On the roentgenogram the gonion on the right and left side is simultaneously revealed. When the exposure is made in the dextro-sinistral posture the left jaw, being nearest the plate, casts a silhouette that may be identified on the roentgenogram as smaller than the right jaw, which is further removed from the plate; so that roentgenographically the gonion to be used for anthropometric measures is that revealed on the smallest lower jaw outline.

Gnathion—See Menton.

Inion—The most prominent point of the external occipital protuberance. Now of secondary importance, it may be absent in some cases, or may be present as a double point with a depression between.

Lambda—The meeting point of the sagittal and lambdoid sutures. Easily identified in most roentgenograms.

Maximum occipital point—The point on the squamous part of the occipital most distant from the glabella. It is identified on the roentgenogram with the centimeter scale, the zero end of which is applied to the glabella, and with this point as a pivot the scale is encircled over the occipital silhouette noting that point on the outer table farthest distant from the glabella. In the identification of the maximum occipital point, the maximum anteroposterior diameter of the skull is ascertained.

Menton—The lowest point in the middle of the bony chin. In median sagittal projection, the lower jaw casts a typical silhouette of the symphysis. This may be recognized on the roentgenogram as an elongated ellipse holding the inferior median incisors at its upper pole and the menton at its lower pole. The walls of the ellipse are plainly recognized as radiopaque boundaries including between them the spongy reticulum of the alveolar process. Roentgenographically the menton is the lowest point on the silhouette of the symphysis.

Nasion—The nasion is the median point of the nasofrontal suture. It is always to be identified on the roentgenogram where it reveals itself as a distinct notch between the nasal and frontal bones.

Obelion—The point on the sagittal suture on a line with the parietal foramina (when both foramina are absent the point may be estimated by comparing various skulls. In the roentgenogram the obelion is not revealed, nor does it have any roentgenographic significance in this study.

Ophryon—The central point of the smallest transverse diameter of the fore-

head measured from one temporal line to the other. (Obsolete.)

Opisthion—The middle of the posterior margin of the foramen magnum. This can not be visualized on the roentgenogram excepting in rare cases, and is, therefore, not used in this survey.

Pogonion — The most prominent point of the bony chin. Easily observed on the roentgenogram.

Pterion—The point of juncture of the spheno-parietal articulation.

Sub-nasal points—The lowest point, on each side, on the lower border of the nasal aperture. These points are lower than the top of the nasal spine; but in roentgen ray anthropometry it suffices to use the point on the nasal spine.

Stephanion—The point where the coronal suture crosses the temporal line. It is not visualized on the roentgenogram. It is obsolete.

Vertex—The summit of the cranial vault. Roentgenographically, it may be represented as the greatest diameter from the external auditory meatus to the vault.

In addition to these landmarks there is one used in cephalometry that may also be utilized in roentgen ray anthropometry. In the roentgenogram among the air cells of the mastoid will be observed an ovoid radioparency representing the silhouette of the external auditory meatus. This oval is traced with a soft pencil. The uppermost point of the oval thus traced is especially marked and forms the basis for the measure of many diameters. It is cumbersome to refer to this newly submitted point by its full name, the uppermost point of the external meatus; so that this phrase may be arbitrarily condensed into the single word "akoustion." In this thesis akoustion will be used to mean the roentgen ray anthropometric landmark just described.

The supra-endoglabella is the point obtained as follows: When the maximum length of the skull is ascertained, which includes the distance between the glabella and the furthest occipital point, the endo-occipital point is established as that point inside the skull that corresponds to the furthest occipital point on the outside of the skull; and with the endo-occipital point as a pivot the rule is swung upward on the frontal bone until the maximum internal diameter is reached. This will be found generally at a point just above the frontal sinuses on the inside of the skull, which point is designated the supra-endoglabella.

The turcicon is the estimated central point of the sella turcica.

It seems undesirable to create additional terms for the already great anthropologic vocabulary, though there are certain undescribed points in the cranium that permit of interesting roentgenological study. Reference is made to internal cranial landmarks. These will be designated by prefixing "endo" before the particular landmark in question. The aim should be to reduce rather than to multiply craniometric measures and indices. Broca says, with aptitude, that given any two points on the cranium, these may be used for the determination of an arc or a chord the study of which offers a certain amount of interest; and so with angles and indices. The number of cephalometric landmarks is, therefore, indefinite. No landmark, however illy chosen, can be without some significance; but it remains that the best interest of anthropologic enquiry can be arrived at through the use of the fewest possible landmarks that afford the greatest amount of information. With this object in view, therefore, the roentgenologist will be interested in only the following roentgen ray anthropometric points:

Akoustion
Alevolar point
Bregma
Endo-bregma
Glabella
Supra-endoglabella
Lambda
Endo-lambda
Maximum occipital point
Menton
Nasion
Pogonion
Vertex
Endo-vertex
Turcicon

Measures

As in the landmarks, so are there in the measures of the skull endless possibilities for interesting observation. In Part IV of this monograph the Monaco Agreement and the Geneva Agreement are presented in full; but of the various measures of the skull and head presented in these two agreements, only those will be selected that are of roentgenologic interest.

It will be noted that no mention has been made of an anteroposterior exposure of the skull with the view of eliciting any of the lateral measures such as the maximum breadth or greatest transverse diameter. There are two reasons for this omission. In the first place with ordinary roentgenographic skill, it is a matter of extreme difficulty to secure plates that furnish sufficient detail for

NO. 2

ROENTGEN RAY ANTHROPOMETRY
(Measures)

(Made according to prescribed Roentgen Ray Anthropometric Standard)

MEASURE					
1. Maximum length of skull. (glabella to occiput)					
2. Maximum internal length. (supra-endoglabella to endo-occiput)					
3. Akoustio-bregmatic height. (akoustion to bregma)					
4. Akoustio-endobregmatic height (akoustion to endobregma)					
5. Naso-menton diameter. (nasion to menton)					
6. Naso-alveolar diameter. (nasion to alveolar point)					
7. Facial depth.					
Identification number					
Name					
Age					
Sex					

Note: The values recorded are uncorrected for Roentgen-Ray divergence. To correct apply protractor reading of bob, which is _____.

any measure other than the greatest transverse diameter; and, therefore, it was felt inadvisable to make an additional exposure simply to procure one diameter which can well be dispensed with for routine study. In the second place, anthropometrically studied, roentgenograms require such exacting technique in anterposterior exposure as to tax the patience of the roentgenologist; so that to insist on this view would make for initially dissatisfying results, and, therefore, for hindrance in the studying of this science. For these reasons only the median sagittal projection of the skull is used. Based on the agreements of the Monaco and Geneva Convention, and modified so as to include certain original endocranial measures, there is here offered a standard for roentgen craniometric and roentgen cephalometric measurements.

A—Roentgen Cephalometry

1. *Maximum length of the skull or greatest anteroposterior diameter.* This is the maximum glabella-occipital diameter of the vault. *Landmarks:* Anteriorly, the most prominent point of the glabella; posteriorly, the most prominent point on the occiput as shown by the maximum distance determinable by the centimeter rule.

2. *Maximum internal length of the skull or greatest endoanterior-endoposterior diameter.* This is the maximum supra-endoglabella-endo-occipital diameter of the vault. *Landmarks:* Anteriorly, the supra-endoglabella; posteriorly, the internal cranial point immediately perpendicular to the corresponding most prominent point on the external occiput.

3. *The akoustic-bregmatic height.* This is the distance in centimeters and millimeters separating the akoustion and bregma. *Landmarks:* Inferiorly, the akoustion; superiorly, the bregma.

4. *The naso-akoustion diameter.* This is the length between the nasion and the akoustion. *Landmarks:* Anteriorly, the nasion or median point of the naso-front suture; posteriorly, the akoustion.

5. *The akoustio-alveolar diameter.* The strip between the akoustion and alveolar point. *Landmarks:* Anteriorly, the alveolar point; posteriorly, the akoustion.

6. *The nasomenton diameter.* The distance separating the nasion and menton. *Landmarks:* Above, the nasion; below, the menton.

7. *The naso-alveolar diameter.* The distance between the nasion and alveolar point. *Landmarks:* Superiorly, the nasion; inferiorly, the alveolar point.

8. *Height of the symphysis of the lower jaw. Landmarks:* Superiorly, the highest point of the alveolar border; inferiorly, the menton.

B—Cephalometry

1. *Maximum length of the head or the maximum anteroposterior diameter* determined as on the skull. *Landmarks:* The perpendicular projection of the glabella onto the silhouette of the skin surface, and posteriorly, the perpendicular projection of the most prominent occipital point onto the skin.

2. *Height of the head. Landmarks:* Superiorly, the perpendicular projection of the vertex onto the skin; inferiorly, the akoustion.

In addition to these a useful measure in connection with the cranio-facial angle, as modified from that presented by Bean, consists in the following: The nasion and menton are connected by a straight line. The shortest distance between the akoustion and this line is measured and recorded as the *facial depth.* There are many other measures that can be taken and used to great advantage. It is only necessary to consider the ones enumerated, as these conform with great accuracy to similar measures conducted on the skull or in the living by the accepted formulae promulgated by contemporaneous anthropologic authorities. The measures above described will be referred to as the roentgen ray anthropometric standards. To systematize and to expedite the records, a chart for recording these various measures may be compiled. The one used in this study is shown in stencil No. 2. At the foot of this chart the notation occurs that the recorded measurements are uncorrected for roentgen ray divergence. Either at the conclusion, but better at the beginning of a series of measurements, the divergence protractor is applied to the roentgenogram and the bob reading immediately recorded on the sheet, and the coefficient used for correcting the distorted lengths to their true values.

Capacity of the Skull

An estimate of cranial capacity corresponds closely to the volume of the brain. It is, therefore, of considerable importance though extremely difficult to arrive at. In the case of the dry skull a special technique must be followed according to the various methods which Hrdlicka divides into five groups. Though varying in the method of attack, these five groups represent various means for filling the skull with some substance, the volume of which is afterwards measured.

Methods for computing the cranial capacity have been submitted by Beddoe and Froriep. Froriep's method is

NO. 3 ROENTGEN RAY ANTHROPOMETRY

(Indices)

INDEX					
1. Endocranial module; 1/3 (sum of supra-endoglabella and twice akoustic-endobregmatic diameters.					
2. Facial angle; Included between naso-alveolar and akoustio-alveolar lines.					
3. Sphenoidal angle; Included between naso-turcicon and turcico-akoustion lines.					
4. Height index; $\frac{\text{akoustio-bregmatic} \times 100}{\text{maximum length}}$					
5. Cranio-facial index; $\frac{\text{naso-menton plus facial depth} \times 100}{\text{maximum length plus akoustio-bregmatic}}$					
6. Jaw-face index; $\frac{\text{naso-alveolar} \times 100}{\text{naso-menton diameter}}$					
Identification number					
Name					
Age					
Sex					

an advancement over that communicated by Beddoe and will, therefore, be discussed at this time. Froriep determines the relation that exists among the diameters of the three ellipses of the skull; that is, the horizontal, the vertical and the median sagittal. His studies show that by halving the value for each of the diameters of these ellipses and multiplying their combined products by 4/3 of π (4/3 of 3.1416) a figure is arrived at which very closely approximates the measured capacity of the skull. In his study it was attempted to develop a system whereby the cranial capacity of the living head could be determined; so that for the basion-vertical height of the skull Froriep used instead the height between the vertex and the uppermost point of the external auditory meatus. Froriep arbitrarily assigned value for the thickness of the skull to be subtracted from the various lengths. The method of Froriep may be summarized as follows:

Let L=the length of the skull.
B=the maximum breadth of the skukll.
H=the maximum height of the skull.
l=correction for length depending upon thickness.
b=correction for breadth.
h=correction for height.

The table of corrections is as follows:

			l	b	h
Sehr duennwandige [1]	Schadel	I.....	7	6	4
Duennwandige	"	II.....	9	7	5
Mittelstarke	"	III.....	12	8	5
Dickwandige	"	IV.....	15	10	7
Sehr dickwandige	"	V.....	18	12	8

From these measures and from this table, Froriep advanced the following formula:

$$\text{Capacity} = \frac{(L-l)\ (B-b)\ (H-h)}{2}$$

His monograph is accompanied by nearly 200 determinations in which the difference between the calculated and the determined capacity was shown in many instances to be slight, though it occasionally varied to the extent of 50 cubic centimeters and sometimes to over 100 cubic centimeters. It would seem that Froriep's method for estimating cranial capacity on the living is undoubtedly the best of any of the arithmetical methods advanced for this purpose. A weighty criticism that can be justly leveled against Froriep's method is the arbitrary manner in which corrections for the thickness of the skull are applied. To overcome this objection, an original method based on the measures derived from the roentgenogram will be advanced.

The ellipse may be recorded as obtained by a projection of the circle, and the ellipsoid by projection of the sphere. Hence, the area of an ellipse whose axes are 2a and 2b is π ab, (π = 3.1416); and the volume of an ellipsoid whose axes are 2a, 2b and 2c is 4/3 π abc. Now, if the sagittal endocranial contour is traced it will be found to be very nearly elliptical; and the maximum internal anteroposterior diameter (endo-occiput to supra-endo-glabella) approximately represents the major axis of this ellipse, or 2a. Similarly, the akoustio-endo-vertex height represents the axis of the coronal ellipse, or 2b. The axis of the breadth of the skull in many cases agrees closely in value to the axis for the height; so that for purposes of comparative study 2c may be considered as equivalent to 2b. From these considerations the formula for the volume of the endocranial ellipsoid becomes:

$$\frac{4/3 \times 3.1416 \times a \times b \times b}{2\ \ 2\ \ 2}$$

or, simplifying—

$$\text{Volume} = \frac{a \times b^2}{2}$$

where

a=internal length, from supra-endo-glabella to endo-occiput.

b=internal height, from akoustion to endo-vertex.

Since this method, the arithmetic of which is in every way similar to that used by Froriep, uses the internal measures of the skull, and thereby eliminates the arbitrary corrections for thickness, it should be expected and does give results that at least as nearly approximate the measured skull capacity as the corresponding values obtained by Froriep's formula.

Reichardt determined that the volume of the brain is about 10 per cent less than that of the skull capacity; so that 90 per cent of the calculated skull capacity may be used as the figure to represent the volume of the brain.

Since roentgen ray anthropometry aims for precision and simplicity, and further, because the endocranial form is not accurately ellipsoidal, these are excellent reasons for dismissing the calculation of cranial and encephalic capacity, and to use in their stead the so-called cranial module of Schmidt. Schmidt added the length, breadth and height of the skull and divided these by three, calling the figure thus obtained the cranial module. In a similar manner, the akoustio-endobregmatic height, doubled, and the maximum internal diameter of the skull, may be added and divided by three, giving a figure called the roentgenographic internal module of the cranium. Cranial capacity is calculated from the same figures that enter into the cranial module; so that the roentgenographic internal module forms a valuable index to cranial capacity in every way as useful as the calculated capacity. (For other discussions of formulae used in the estimation of cranial capacity see Topinard, Broca, Manouvrier, Beddoe, Lee and Duckworth).

From a lateral view of the head alone it would seem conducive to error to obtain the cranial module by doubling the value for the height, on the basis that the breadth and height tend closely to approximate one another. That this error is not really an appreciable one can be demonstrated from the figures of Froriep, which figures are reproduced in the accompanying table. (See Table IV). In columns two, three and four of Froriep's table are given, respectively, the total length, breadth and height of the skulls. Froriep gives the dimensions in millimeters rather than in centimeters and fractions, which is the preferable custom. In column five, the cranial module calculated by the method of Schmidt and from the figures of Froriep is reproduced from Froriep's table; and in column six is given the cranial module calculated by taking one-third of the sum of the length and twice the height, again using Froriep's figures. It will be observed that the difference in the two methods in many instances amounts to a small fraction, so small as to be within reasonable experimental error.

Angular Measurements

From linear measurements one passes to measurement of angles. A considerable number of angles have been measured and described, but only those need be selected in which the value of the angle is significant in judging of the morphological conformation and comparative anatomical variation of the skull. The best known of these angles is the facial angle, useful as a means of illustrating the difference between the degrees of prognathia in different skulls, or better to study the evaluation of prognathism from fetal to adult life in a single individual with the view to establishing the apparent age of arrested development. As described by Camper,

TABLE IV.

EXPLANATION:--Columns 1, 2, 3 and 4 are copied from the table of Froriep. Column 5 is the cranial module determined from the figures taken from the table of Froriep and estimated by the method of Schmidt; by adding the length, breadth and height and dividing by 3. Froriep recorded his value for length, breadth and height in millimeters. A usage that conforms more with the accuracy of the investigation is that of recording these values in centimeters and decimals; therefore, the cranial module of Schmidt as calculated from Froriep's figures is reported as a whole number and tenths. Column 6 is obtained by adding Froriep's value for the length and twice Froriep's value for the height, dividing by 3, and recording the result in decimals as for the cranial module of Schmidt. This column is labelled "x-ray module". It is not strictly a true expression of the x-ray module as defined in this thesis; for in this table the figures given by Froriep are external diameters, whereas in roentgen ray anthropometry endocranial measures are used to determine the endocranial module. It will be noticed that the module of Schmidt and the x-ray module, as calculated from Froriep's figures and without applying any correction for the thickness of the part in either case, nevertheless agree with reasonably close approximation. It seems certain that were corrections applied for the thickness of the part and the module as calculated compared to the true x-ray endocranial module, the approximation of both values would be even closer than that already proved to exist.

1 Identification Number (Froriep)	2 Length	3 Breadth	4 Height	5 Cranial Module (Schmidt)	6 X-ray Module	7 Variation
204	147	150	119	13.9	12.8	1.1
155	157	134	119	13.7	13.2	.5
110	160	135	119	13.8	13.5	.3
198	177	128	119	14.1	13.8	.3
201	168	151	124	14.1	13.9	.2
203	162	140	127	14.3	13.9	.4
158	185	121	122	14.2	14.2	.0
224	169	142	116	14.2	13.4	.8
231	161	137	130	14.3	14.0	.3
39	172	137	126	14.5	14.1	.4
1	160	141	127	14.3	13.8	.5
130	165	139	124	14.3	13.8	.5
132	167	140	127	14.5	14.0	.5
230	168	139	126	14.4	14.0	.4
127	172	146	134	15.1	14.7	.4
9	163	136	125	14.1	13.8	.3
152	165	145	126	14.5	13.9	.6
37	180	136	120	14.5	14.0	.5
172	160	135	121	13.9	13.4	.5
58	178	140	129	14.9	14.5	.4
164	174	132	136	14.7	14.9	.2
76	171	135	132	14.6	14.5	.1
120	171	142	120	14.4	13.7	.7
60	172	137	131	14.7	14.5	.2

TABLE IV (Continued).

1 Identification Number (Froriep)	2 Length	3 Breadth	4 Height	5 Cranial Module (Schmidt)	6 X-Ray Module	7 Variation
176	175	139	130	14.8	14.5	.3
99	163	142	129	14.5	14.0	.5
52	171	140	122	14.4	13.8	.6
83	170	146	126	14.7	14.1	.6
95	177	145	119	15.0	13.8	1.2
92	175	141	122	14.6	14.0	.6
133	175	149	127	15.0	14.3	.7
195	160	141	125	14.9	14.3	.6
28	176	144	122	14.7	14.0	.7
77	167	145	117	14.3	13.4	.9
161	169	150	136	15.1	14.6	.5
186	175	145	121	14.7	13.9	.8
36	174	144	125	14.8	14.1	.7
137	167	146	128	14.7	14.1	.6
106	168	145	127	14.7	14.1	.6
211	182	138	131	15.0	14.8	.2
42	172	142	128	14.7	14.3	.4
11	181	145	133	15.3	14.9	.4
40	174	141	121	14.5	13.9	.6
173	168	138	127	14.4	14.1	.3
38	176	142	127	14.6	14.3	.5
194	171	135	134	14.7	14.6	.1
202	168	148	132	14.9	14.4	.5
210	136	135	127	14.9	14.7	.2
43	177	147	128	15.1	14.4	.7
150	187	137	129	15.1	14.8	.3
225	165	150	127	14.7	14.0	.7
179	173	140	131	14.8	14.5	.3
84	170	145	130	14.8	14.3	.5
159	170	138	138	14.9	14.9	.0
68	174	151	125	15.0	14.1	.9
135	179	142	133	15.1	14.8	.3
103	167	146	126	14.6	14.0	.6
96	174	139	131	14.8	14.5	.3
163	179	138	130	14.9	14.6	.3
192	172	145	132	15.0	14.5	.5
101	177	147	120	14.8	13.9	.9
88	182	147	131	15.3	14.8	.5
33	164	149	125	14.6	13.8	.8
113	168	141	128	14.6	14.1	.5
141	202	128	132	15.4	15.5	.1
22	173	147	127	14.9	14.2	.7
162	179	139	131	15.0	14.7	.3
128	179	149	133	15.4	14.8	.6

TABLE IV (Continued).

1 Identification Number (Froriep)	2 Length	3 Breadth	4 Height	5 Cranial Module (Schmidt)	6 X-Ray Module	7 Variation
54	171	144	126	14.7	14.1	.6
91	177	136	121	14.5	14.0	.5
142	182	140	133	15.2	14.9	.3
144	169	154	128	15.0	14.2	.8
32	167	147	129	14.8	14.2	.6
233	173	145	124	14.7	14.0	.7
168	180	144	126	15.0	14.4	.6
131	185	144	128	15.2	14.7	.5
6	175	145	132	15.1	14.6	.5
19	183	136	130	15.0	14.8	.2
215	175	134	141	15.0	15.2	.2
138	169	145	140	15.1	15.0	.1
220	176	140	129	14.8	14.5	.3
29	180	148	124	15.1	14.3	.8
123	187	143	133	15.4	15.1	.3
2	182	148	125	15.2	14.4	.8
66	167	142	136	14.8	14.6	.2
79	176	149	136	15.4	14.9	.5
109	183	144	131	15.3	14.8	.5
174	188	149	127	15.5	14.7	.8
73	181	145	136	15.4	15.1	.3
166	184	147	137	15.6	15.3	.3
209	180	148	133	15.4	14.9	.5
235	184	136	134	15.1	15.1	.0
23	172	147	129	14.9	14.3	.6
26	180	142	125	14.9	14.3	.6
171	192	136	133	15.4	15.3	.1
184	179	149	127	15.2	14.4	.8
199	172	139	140	15.0	15.1	-.1
183	179	149	133	15.4	14.8	.6
15	178	142	125	14.8	14.3	.5
27	177	149	131	15.2	14.6	.6
153	179	146	127	15.1	14.4	.7
13	173	147	127	14.9	14.2	.7
65	177	146	132	15.2	14.7	.5
212	176	144	136	15.2	14.7	.5
189	174	140	147	15.4	15.6	- .2
104	176	146	129	15.0	14.5	.5
93	183	145	139	15.6	15.4	.2
100	178	148	124	15.0	14.2	.8
191	161	149	134	14.8	14.3	.5
80	181	150	127	15.3	14.5	.8
206	168	152	134	15.1	14.5	.6
197	186	135	141	15.4	15.6	- .2
25	188	143	128	15.3	14.8	.5
136	184	136	137	15.2	15.3	- .1
119	175	149	133	15.2	14.7	.5
207	182	138	141	15.4	15.5	- .1

TABLE IV (Continued).

1 Identification Number (Froriep)	2 Length	3 Breadth	4 Height	5 Cranial Module (Schmidt)	6 X-Ray Module	7 Variation
4	177	149	128	15.1	14.4	.7
213	185	139	142	15.5	15.6	-.1
165	185	146	133	15.5	15.0	.5
55	188	141	127	15.2	14.7	.5
169	174	152	128	15.1	14.3	.8
200	183	140	143	15.5	15.6	-.1
232	180	146	132	15.3	14.8	.5
182	182	144	142	15.6	15.5	.1
185	176	147	131	15.1	14.6	.5
59	180	148	136	15.5	15.1	.4
111	178	147	139	15.5	15.2	.3
157	172	156	138	15.6	14.9	.7
31	176	155	133	15.5	14.7	.8
154	173	146	144	15.4	15.4	.0
190	171	148	139	15.3	15.0	.3
5	175	147	131	15.1	14.6	.5
214	174	143	139	15.2	15.1	.1
Von Mohl	177	148	140	15.4	15.2	.2
7	172	147	135	15.1	14.7	.4
219	180	151	135	15.5	15.0	.5
61	182	155	131	15.6	14.8	.8
216	185	148	135	15.7	15.2	.5
160	180	144	125	15.0	14.3	.7
226	180	144	127	15.0	14.5	.5
124	176	146	122	14.8	14.0	.8
108	172	144	132	14.9	14.5	.4
3	181	146	127	15.1	14.5	.6
57	184	147	140	15.7	15.5	.2
196	184	132	137	15.1	15.3	-.2
188	181	148	128	15.2	14.6	.6
134	185	143	139	15.6	15.4	.2
156	180	154	125	15.3	14.3	1.0
94	186	145	131	15.4	14.9	.5
122	190	147	128	15.5	14.9	.6
180	173	157	123	15.1	14.0	1.1
218	178	152	128	15.3	14.5	.8
102	182	145	140	15.6	15.4	.2
139	180	156	135	15.7	15.0	.7
48	189	137	139	15.5	15.6	-.1
208	173	144	144	15.4	15.4	.0
98	190	145	131	15.5	15.1	.4
145	181	149	140	15.7	15.4	.3
175	189	146	132	15.6	15.1	.5
46	187	145	132	15.5	15.0	.5
24	177	156	129	15.4	14.5	.9
143	177	154	128	15.3	14.4	.9
229	177	156	136	15.6	15.0	.6

the facial angle is included between two lines, a facial line and a base line or horizontal. The facial line is tangential to the most prominent part of the frontal bone in the neighborhood of the glabella, passes downward and is tangential to the slight convexity forwards of the upper incisor teeth; the lack of definition of the latter lower point is due to the fact that the angle was described by Camper as determinable upon the head where clothed with the soft tissues as in life, just as conveniently as upon the macerated skull. The facial line in the head passes through the point of contact of the lips as seen in profile; this is best represented by the most anterior point on the surface of the upper incisor teeth, and this consideration has determined its selection in the skull.

The horizontal or base line adopted by Camper passed through the lower part of the nasal aperture downward along the line of the zygomatic arch, and through the center of the external auditory meatus, and in the case of the measurement being made upon a head, the line approximately corresponds to that of the nostril as seen in profile. The two including lines are found to intersect in the neighborhood of the nasal spine and the angle thus formed was shown by Camper to vary from a comparatively small number of degrees in the skull of lowly mammals, ascending through the higher mammalia, and the apes, and thus gradually through the negro to the white human type, culminating in the idealized heads which Greek artists of antiquity gave to their masterpieces of sculpture (Duckworth). With the progress of anthropometry, and notably through the Frankfort Congress, the definition for the facial angle gradually varied, being adopted in its final form at present according to the definition presented by Hrdlicka, the angle between the basion-alveolar point and alveolar point and nasion lines.

TABLE IV (Continued).

1 Identification Number (Proriop)	2 Length	3 Breadth	4 Height	5 Cranial Module (Schmidt)	6 X-Ray Module	7 Variation
167	186	146	131	15.4	14.9	.5
97	175	150	129	15.1	14.4	.7
221	183	156	131	15.7	14.8	.9
178	189	150	134	15.8	15.2	.6
170	171	162	127	15.3	14.2	1.1
71	176	156	135	15.6	14.9	.7
34	185	152	133	15.7	15.0	.7
118	188	150	140	15.9	15.3	.6
114	179	148	137	15.5	15.1	.4
112	180	148	142	15.7	15.5	.2
227	184	148	132	15.5	14.9	.6
178	176	157	136	15.6	14.9	.7
90	186	151	126	15.4	14.6	.8
67	182	148	128	15.3	14.6	.7
107	178	147	136	15.4	15.0	.4
74	190	150	127	15.6	14.8	.8
8	173	147	129	15.0	14.4	.6
53	183	144	137	15.5	15.2	.3
63	173	153	130	15.2	14.4	.8
81	178	149	135	15.4	14.9	.5
89	191	154	126	15.7	14.8	.9
50	181	146	133	15.3	14.9	.4
75	174	149	134	15.2	14.7	.5
85	181	157	126	15.5	14.4	1.1
228	172	161	131	15.5	14.5	1.0
69	186	144	146	15.9	15.9	.0
10	180	153	135	15.6	15.0	.6
87	192	152	132	15.9	15.2	.7
181	176	153	137	15.5	15.0	.5
56	197	160	121	15.9	14.6	1.3
149	185	156	138	16.0	15.4	.6
17	178	153	133	15.5	14.8	.7
41	185	151	131	15.6	14.9	.7
16	184	154	129	15.6	14.7	.9
140	185	156	125	15.5	14.5	1.0
129	187	160	135	16.1	15.2	.9
125	189	155	141	16.2	15.7	.5
18	186	159	126	15.7	14.6	1.1
117	183	154	138	15.8	15.3	.5
64	188	153	139	16.0	15.5	.5
72	186	156	142	16.1	15.7	.4
187	180	154	133	15.6	14.9	.7
222	185	151	131	15.6	14.9	.7
217	184	155	127	15.5	14.6	.9
82	184	153	148	16.2	16.0	.2
14	181	155	132	15.6	14.8	.8
193	183	156	128	15.6	14.6	1.0
30	196	158	126	16.0	14.9	1.1
236	184	155	139	15.9	15.4	.5
62	182	162	143	16.2	15.6	.6

For purposes of roentgen ray anthropometry the facial angle may be described as that included between two lines, the first drawn from the nasion to the alveolar point, and the second from the alveolar point to the akoustion. This very nearly corresponds with the definition given by Hrdlicka and affords comparable value that adds much to the study of the morphology of the skull.

Sphenoidal Angle

The sphenoidal angle was introduced by Virchow and studied by Welcker. In roentgen ray anthropometry it may be described as the angle included between two lines, the first drawn from the nasion to the turcicon (middle point of sella turcica), and the second from the turcicon to the akoustion. It presents an inverse evolution in man and in quadrumana, during growth. That is, in the sajou apes and in the orang the sphenoidal angle becomes more obtuse with advancing age; but in man, the reverse holds true, the sphenoidal angle becoming more acute as the individual passes from infancy to childhood, adolescence, and finally adult age. Obtuse sphenoidal angles in men point to platybasia and would indicate morphologically arrested basal skull development; and contrariwise, acute sphenoidal angles signify basal kyphosis indicative of exaggerated development.

Other Angles

Duckworth mentions other angular measurements that are made on the sectioned skull, and for which, therefore, the roentgenographic median sagittal projection of the cranium is admirably adopted. There are included the sphenomaxillary angle, spheno-ethmoidal angle and the foramino-basal angle. For a discussion of these various angular measurements, which will not be included here, reference may be had to Duckworth's "Morphology and Anthropology."

Thickness of Flesh and Bones

It may sometimes be of interest to study the relation that exists between the thickness of the cranial bones as sagitally projected and the immediately everlying fleshy structures for studying the thickness of the cranial vault, etc. The method described by Pacini is extremely useful. This method may be modified to include not only the inner table and the outer table of the vault, but also the skin. In substance, the method consists in drawing a base line that extends through the nasion, through the middle point of the sella turcica and the prolongation of the line joining these points through the occiput. The distance between the nasion and occipital point is halved. With this new point

as a center an arc is superscribed over the cranium. The radius of this arc as used by Pacini, is the distance between the central point of the base line described and the alveolar point. It is not necessary to inscribe a second arc. The one hundred and eighty degrees included in the semicircle are divided into ten sectors each eighteen degrees apart. On each of these sectors the thickness in millimeters of the skin is compared to the thickness in millimeters of the bone; and from these figures the relation that exists between bony and muscular structure can be measured and studied.

In general, the fleshy parts increase proportionally as the thickness of the vault increases; so that in the frontal region there is relatively thin flesh over a thin frontal cranium, and in the occipital region a thick flesh over a thicker occipital cranium. In some cases a reversed order may be observed, one in which there is a thick musculature over a thin frontal cranium, and a thin musculature over a thick occipital cranium. These cases seem to suggest anomalous development in which the bone grew independently of the muscular superstructure. In routine roentgen ray anthropometry so detailed a study as the measured relation that occurs between the muscle and the bone of the cranium need not be entered into. It is alone sufficient qualitatively to observe the general proportion that exists between these two structures and to note any deviation from the normal relation, considering as a normal relation thin vault and thin flesh, and thick vault with thick flesh.

SECTION C—INDICES

In the preceding sections an outline was submitted for studying craniologic description, to which was appended a list of measurements which prove useful in enabling comparisons to be made more exactly than by the method of inspection alone. It may be mentioned that certain writers in anthropology entirely disregard, or disregard to a large extent, the numerical craniometrical method. Sergi, of the Italian school, is foremost in the most recent move in this direction. The other extreme has been reached by such observers as Torok, Benedikt and others whose contributions to craniology are replete with vast numbers of detailed measurements. Measurements are of unquestionable utility and it is, therefore, incontrovertible that if they are made at all they should be derived by a method that insures accuracy and serves at the same time as a basis for adequate comparison.

Having obtained the numerical data the next natural step is a direct comparison of the corresponding figures relating to different examples. Because of their usefulness and stability, anthropometric indices early gained great favor and importance and have also become greatly multiplied. The value of some, however, particularly that of the cephalic index, has been markedly overrated.

INDICES

The fundamental concept in the construction of an index is that the single numerical expression shall be so devised as to yield an "indication" of the proportion or relation obtaining between certain quantities, which in anthropometry have generally been limited in number to two. An index, therefore, expresses a percental relation of two measurements; and by custom it is habitual to use the smaller measurement as the dividend and the larger as the divisor, so that all anthropometric indices are less than one hundred.

The indices that it has been thought advisable to use in connection with this study may be enumerated as follows:

1. The height index, which compares the cranial height with the cranial length.
2. Craniofacial index, which is the relation obtained by comparing the dimensions of the head and face.
3. The jaw-face index, expressing the relation between the upper and the lower jaw.

HEIGHT INDEX

It was Retzius who first promulgated the cephalic index, the importance of which was exceptionally manifest from the beginning, but has subsequently been unduly overrated. The general form of the cranium, above all, depends upon the existing relation of its length and its breadth; and on these relations Retzius introduced the classification of dolichocephalic, or long headed races; and brachycephalic, or short headed races. An intermediate group was added by later writers and called mesaticephalic (Broca). In working with the living head or skull the cephalic index is more readily and accurately ascertained than the height index; but in studying sagittal roentgenograms, the height index is easier to determine, and affords information as valuable as the cephalic index. In human crania, the height index varies quite directly with the breadth index, so that where the skull is elongated (dolichocephalic), there is to be expected a small figure representing the height index. The height index is modified somewhat by age, by sex, and by race. In fetal stages the head tends to relatively greater height as compared to the length than occurs in adult stages. The female, usually relatively dolichocephalic, shows a correspondingly lower height index than the male. Inferior races that tend to dolichocephaly and sacrocephaly show also a low figure for the height index.

Mueller very carefully studied the profile curves of the skull of the newborn and their relationship to the birth canal and to the adult form of skull; and concluded from his studies that for each type of obstetrical presentation the head assumes a more or less permanent moulding with regard to its main diameters in a fashion to permit an inference as to the type of delivery from the general contour of the skull. The height-length index is determined from the following formula:

$$\frac{\text{Akoustio-bregmatic height} \times 100}{\text{Maximum length of skull}}$$

CRANIO-FACIAL INDEX

From an anthropologic point of view, as well as in an anatomical sense, the skull is divided into two parts, the *cranium* and the *face*. Each of these regions has its special indications, while new characters again arise from their reciprocal relations. The cranium and the face are ontogenetically of different derivation. According to the vertebral theory the cranium is a modified vertebral vestige, as is also the facial framework; but the cranial modification has far exceeded the facial modification, so that while both are essentially of pristine vertebral origin, in their present form the face is more nearly vertebral than the cranium. An expression of the reciprocal relation that exists between cranial and facial development should, therefore, prove of valuable morphologic significance.

According to Bean the size of the face varies with age, sex, race and with inter-racial types; whereas the size of the head varies so little that it may be used to compare the size of the face,

TABLE IV (Continued).

1 Identification Number (Froriep)	2 Length	3 Breadth	4 Height	5 Cranial Module (Schmidt)	6 X-Ray Module	7 Variation
126	199	151	135	16.2	15.6	.6
86	195	161	133	16.3	15.4	.9
116	186	153	132	15.7	15.0	.7
12	190	174	126	16.3	14.7	1.6

obtaining in this way an index that provides at once the relative and absolute size of the face. The same author submits that the most complete craniofacial relationship would be obtained by dividing the length plus the breadth, plus the depth of the face, by the length plus the breadth, plus the height of the head. Not all of these measures are usually secured, and Bean therefore utilizes two dimensions of the face and two dimensions of the head. He advances as the cranio-facial index the quotient of the chin to the nasion diameter plus the bizygomatic diameter of the face, divided by the glabella, to the maximum transverse diameter of the head. It represents the size of the face in terms of the head as one hundred. When the face is large the craniofacial index is large, and vice versa.

For roentgenographic purposes similar results may be obtained from the values of the height and depth of the face compared to the height and depth of the cranium. The roentgenographic craniofacial index may, therefore, be expressed by the following formula:

$$\frac{\text{Naso-menton diameter plus facial depth} \times 100}{\text{Maximum length of skull plus akoustio-bregmatic height}}$$

From roentgenographic studies the features of the growth of the face as represented by the craniofacial index is that in the girl the face is larger than in the boy at an early age; later the converse obtains, the face of the boy being relatively larger than that of the girl; and as adolescence is reached, the index again reverses assuming its pristine difference wherein the face of the girl is larger than that of the boy. According to Bean, and also as the result of roentgenographic survey among subjects showing endocrine deficiencies, the lowest facial indices are to be observed in those showing the highest height-length indices, and the highest craniofacial indices are found in those showing the lowest height-length proportions. Bean has divided subjects into three types which he calls, respectively, the hypo-onto-morphs, the meso-onto-morphs, and the hyper-onto-morphs. Each is characterized by the tabulated features in Table V.

TABLE V

Hypo-onto-morph	Meso-onto-morph	Hyper-onto-morph
Brachycephalic	Mesocephalic	Dolichocephalic
Platyrrhine	Leptorrhine	Leptorrhine
Small stature	Medium stature	Tall stature
High umbilicus		Low umbilicus
Sound teeth	Sound teeth	Badly decayed teeth
Highly susceptible to diseases of the tissues derived from mesothelium (circulatory system)	Highly susceptible to same diseases as hypo-onto-morphs	Highly susceptible to diseases of the tissues derived from epithelium (central nervous system, alimentary canal)
Small face	Large face	Intermediate size face
Short legs	Long legs	Intermediate length legs
Short arms	Long arms	Intermediate length arms
Short, flat nose with depressed root and bridge, flaring nostrils that open forward	Large, straight nose with straight bridge depressed root, nostrils open downward and slightly forward	Long, narrow nose with high root, high bridge, nostrils open downward

It is interesting to observe that the hypo, meso and hyperontomorphic forms represent generally three cardinal divisions of subjects classified according to cryptorhetic dysfunction. Thus, from the viewpoint of endocrine classification the hyperontomorph of Bean is distinctly an individual with a predominant thyroid syndrome.

Jaw-Face Index

The jaw-face index expresses the relation that exists between the face and jaw as measured by the nasomenton diameter and the upper jaw as measured by the nasoalveolar diameter. Its formula is:

$$\frac{\text{Nasoalveolar diameter} \times 100}{\text{Nasomenton diameter}}$$

The relations discussed are best recorded upon the form expressly provided for that end. One in keeping with the system used throughout for registering the findings is that shown as mimeographed form No. 3.

Footnote

(1)—(I, very thin; II, thin; III, medium; IV, thick; V, very thick.)

EDITORIAL

The JOURNAL OF RADIOLOGY

A Journal of Ideas and Ideals.

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ANNUAL MEETING

Hotel Statler, Detroit, Michigan

December 4, 5, 6, 7, 8, 1922

The Role of the Radiologist

THERE is much discussion among the members of the medical profession as to the role of the radiologist. This unsettled state is a natural consequence of the newness of this specialty in medicine. The specialty has become so useful, however, that it may be helpful to discuss some of the fundamental problems which are involved in the relationship of the radiologist to those of his own specialty, to other members of the medical profession, and to the lay public. Without a proper conception of all these phases of his work, the radiologist is unable to function advantageously and he not only suffers, but his medical colleagues and his potential patients—the public—also suffer.

Radiology has a definite position in the practice of medicine which so far cannot be occupied by any other specialty. It enters every phase of the practice of medicine from the realm of fractures to that of neurology.

Although fractures were well diagnosed and well treated before the advent of the x-ray, it cannot be gainsaid that the use of the x-ray in diagnosis and treatment of fractures has promoted better diagnosis and better treatment. As one prominent surgeon recently jokingly remarked, "Before the x-ray came into medicine every fracture was perfectly reduced, but since then none of them are." The truth in this jest is that much more accurate information regarding fractures is now possible than before the x-ray was used. Not only does this information help in producing good alignment and good apposition, but it gives definite knowledge as to involvement of joint surfaces and in the differential diagnosis between a fracture and a sprain. Every surgeon of experience knows of fractures diagnosed as sprains before the advent of the x-ray, which today would be properly diagnosed by its use. A notable example of this value of the x-ray is in injuries to the carpal bones. In fact, a review of medical literature shows that fractures of the carpal scaphoid were infrequently recognized until about the year 1910.

Another field of diagnosis which has been greatly benefited by the use of the x-ray is that of gastro-enterology. The precise location of an ulcer of the stomach and accurate information as to size and character has made both the medical and surgical treatment of this condition more satisfactory. In fact, it has helped the diagnostician to determine with greater certainty whether a given case should be treated medically or surgically. This accuracy of diagnosis has saved or prolonged the life of many patients by the early recognition of gastric cancer and the determination that it could be removed surgically. In this particular field one of our greatest surgeons has said that x-ray ranks second in importance in making a diagnosis of gastric lesions, the history being first and the other methods being of less value. This statement is made by a man who employs all methods of diagnosis, so that he cannot be accused of speaking with bias.

The specialist in urology has also been greatly assisted by the employment of the x-ray in diagnosis. The ability to definitely diagnose stone and to determine its location, as well as to give the exact size of the kidney and the kidney pelvis, has made diagnosis in urology one of the most accurate branches of medicine. Of course, this has been made possible by the use of the electrically lighted cystoscope in conjunction with the x-ray.

These are only a few concrete illustrations of the value of the x-ray in medicine. It would seem, then, that the x-ray has a three-fold value, namely, for positive evidence, for corroborative evidence, and for negative evidence. The concrete examples above illustrate the value of the x-ray in giving positive evidence. Many more could be cited in other branches of medicine. Many times, however, the diagnostician after carefully working over his patient, wishes corroborative evidence, so has the x-ray examination made to make "certainty doubly sure" in order that no doubt may exist in his mind that all the evidence possible has been obtained. In legal parlance, he does not want to pass a verdict until all the evidence has been presented.

The third value, that of the negative evidence, fits in closely with the routine employed by every diagnostician who makes his diagnosis "by exclusion" as so ably taught and exemplified by the late Sir William Osler. That method necessitates the ruling out of every possibility until only the one positive diagnosis remains. The x-ray aids materially in this process.

Every broadminded physician and every broadminded radiologist is compelled to admit that in a diagnostic way the x-ray is an aid, furnishing only a part of the evidence which is used in reaching the verdict medically called a diagnosis. In many instances the evidence furnished by the x-ray far outweighs that obtained by any other method and really contributes so much to the diagnosis that in one's enthusiasm one often thinks it is the diagnosis. In other cases its value is not so positive, but is none the less equally helpful.

It is well for the radiologist to be humble in his attitude toward the remainder of the medical profession, trying always to so equip himself with knowledge that his opinion and help will be sought on every occasion. This means that he must perfect himself in his knowledge of anatomy by study of the cadaver, that he must keep fresh his knowledge of pathology by constant attendance in the surgical operating rooms and the morgue, and that he must be willing to accept the truth regarding interpretations of his x-ray findings. The radiologist must be a teacher, not only in the classroom, but in his daily contact with his colleagues. This attitude on the part of the radiologist is necessary, because in the final analysis the radiologist is radiology, and on him must rest the responsibility of making the specialty what it is.

The field of radiology is so new that many things are yet to be done. Dr. Preston M. Hickey has recently called attention to the need of a uniform system of reports. This point is well taken, and the Journal of Radiology and the Radiological Society of North America could do no more important work than bring this about. It will take years of time to make such a plan universal, but it can be done. From now on the instructors in various medical colleges should follow a definite system of reports for radiographic examinations. In time this scheme, if followed, will give the outgoing medical graduates the proper view of systematic reports.

The development of the field of radiology depends upon the men engaged in it. This responsibility is a heavy one and only the strong man can stand up under it. The service which is demanded of the radiologist is peculiar in that it partakes of the purely laboratory phase of medicine and at the same time is clinical in its character. It really belongs to the clinical side of medicine, because it deals constantly with the actual patient rather than with some excretion or secretion removed from the patient. The work of the radiologist up to this point deals with the patient himself. On the other hand there is the service rendered to the referring physician. The role of consultant is the true position for the radiologist, and he must rise to that high plane if he expects to live his fullest. The radiologist should be guided by the same motto which has proven so valuable to the spirit of the Rotary Club:

"He Profits Most Who Serves Best."

This spirit has made the Rotary Club international in its scope. This spirit is peculiarly adapted to the field of the radiologist, and only by living it each day can he attain the highest pinnacle of this broad specialty. A clear conception of the sphere of the radiologist must be present in the mind of every man practicing this specialty. This unity of view and purpose, coupled with unity of action will result in the "greatest good to the greatest number."

The present day medical profession as a whole is passing through a fundamental change in its socio-economic relationship. As Dr. James A. Gardner says in the leading article of the Journal of the American Medical Association, August 12, 1922, page 515:

> "The physician has always been too busy looking after the needs of his patients to give much time to his own interests."

It would seem that certain influences are causing the members of the medical profession to think more about the relationship of the profession to the outside world. Unless the whole body of medical men awakens to unified action, influences from without will do this thinking for them. Such organizations as the American Medical Association, the American College of Surgeons and the American College of Physicians are doing much to arouse their members to think about the broader relationship of the profession to the public. The underlying principles of the Radiological Society of North America are democratic and tend toward the same socio-economic attitude as the organizations just mentioned. The fact that the membership already exceeds that of any similar organization not only gives great opportunity for this kind of work, but thereby makes it mandatory upon the society to rise to its responsibility.

Brief reference to some of the work already started by the Radiological Society will give some idea of what can be accomplished. The founding of a research fund by the society deals with the very foundation of all progress. It will be recalled that the Lancet recently mentioned this phase of medicine and especially with reference to radiology, where it said in referring to the accomplishments of the British radiologists:

> "We should lead in the subjects embraced under the general head of radiology. It is with pride we regard the great advances in physics which have had their origin in this country.
>
> "The subject is in its infancy; the discoveries of the past may well be eclipsed by those of the future. Let us be prepared to do our share in these advances. *The only efficient way is by the organization and endowment of research.*"

The same sentiment can be embraced as a whole by the radiologists of North America.

Unified action of all agencies making up the radiological profession is also necessary if the most good is to be accomplished. With this in view the Radiological Society of North America followed the plan adopted by the radiologists of Great Britain and by the radiologists of Canada, in licensing technicians. The committee appointed to put this thought into action has completed the organization, and the process of issuing certificates to technicians passing a certain examination is already under way.

Abundant evidence that the public is awakening to thought of the medical profession is found in the lay press. Recent articles have appeared in the Atlantic Monthly, in the Century and in Hearst's International. The latter is written by Dr. Paul H. De Kruif and runs as a series following this first article entitled, "Doctors and Drug-Mongers." Mr. Norman Hapgood devotes his leading editorial to the article mentioned. This editorial is pregnant with thought. For example, Mr. Hapgood says:

> "The series to which we publish this month the introduction, is of no use to those who wish the name of some pill, or some new medical nickname, by resort to which relief can be brought to heart-disease and hiccoughs, to erysipelas and earache, to corns and constipation. It is of no value to a fool. To those, however, who realize that the choice of a doctor is one of the most important of acts, and that medicine has exact technical basis, the series is indispensable."

The first article by Dr. DeKruif deals with the evils of a multiplicity of names for the same drug and also the schemes used in marketing these to both the medical profession and the public. The closing paragraph shows the thought which prompted the article:

> "The medical profession is just now under fire from a pack of quacks and rogues. It knows that its use to the nation is great, and that the camorra of chiropractors, faith healers, and quickish rascals are parasites on our citizens. But its battle against cults and 'isms' and quackery could be waged more strongly were the profession to clear its own house."

When all this comment in the lay and medical press has been finished it is hoped the thoughts presented will result in action beneficial alike to the public and the profession. It should induce the profession to think more broadly and act with more unity than in the past. With this betterment of the medical profession the radiologist should keep well up in the procession of progress.

The Profession and the Public

THE relation of the medical profession to the public is extremely intimate, and this intimate relationship involves a correspondingly great responsibility.

When a man consults a physician he wishes, and has a right to expect, an honest opinion and sound advice. The doctor is supposed to know about disease; he is supposed to have made a study of its various forms and characteristics and of the means of combating it. If the opinion and advice received by the patient result in the cure of his ailment

or in improvement in his condition, the doctor will be respected and that respect will be reflected upon the entire profession; if the disease progresses in spite of the measures prescribed the doctor's ability will be questioned and other advice will be sought; and the quality of the advice sought is usually in proportion to the intelligence of the patient himself.

So, in studying the relations of the medical profession to the public, we must consider two things: the average ability of the profession and the average intelligence of the public.

The average ability of the profession depends, not only on the average quality of the instruction given in medical schools, but also on the average quality of the instruction given in the primary and secondary schools from which the medical schools draw their material.

During the past fifty years this country has grown at a tremendous rate, and this phenomenal development has kept flowing toward our shores a steady stream of more or less illiterate immigrants, each successive influx tending to keep down the educational average of our population. Our school system, still very imperfect, has been hard put in its attempt to keep grinding at least the rudiments of knowledge into this seething and more or less floating mass of immigrants.

One of the great defects in our common school system is its lack of uniformity in standards and curriculum, and in the average caliber of teachers. Until the status of the teacher is raised by adequate remuneration, by pride in his profession as the result of improved and uniform standards, and by the chance of advancement based on ability, we need not expect any great improvement in results. Better teaching, fewer fads, effort concentrated on fundamentals and in developing ability to think, would mean a tremendous saving of time and improvement in results.

The influence of the foregoing factors is still more apparent in the general intellectual average of the population. Recognition of and respect for, the medical profession depend very largely on the educational level of the people, and, therefore, improvement in general education must result not only in a higher average of professional ability on the one hand, but also in greater regard for the profession on the other.

The present curriculum of the medical schools of the country is overburdened with detail. More emphasis must be laid on the three great fundamental branches: anatomy, physiology and pathology, because, with a thorough knowledge of these branches, plus intensive cultivation of the powers of observation, analysis and logic, the solution of any medical problem becomes much less difficult and much more interesting.

The past ten years have witnessed a wave of overspecialization, so that the country is rapidly becoming flooded with specialists and near specialists. With the development of medical knowledge along the line of newly acquired scientific facts, one man cannot hope to keep up with the development in every field of his profession, but, before a physician can claim public consideration as a specialist, the public is justified in demanding reasonable proof of special training and experience.

No man can, in from six weeks to three months, acquire substantial mastery of any important field of medicine, and a specialist should be master of his particular field. Recognition of this fact is leading to more solid graduate instruction.

The multiplicity of state boards for medical licensure is another anachronism that should be done away with at the earliest possible moment. There should be one federal licensing board for the entire country with power to establish proper standards for the protection of the public. The idea of separate licensing boards for osteopaths, chiropractors, and so forth, is made possible by the ignorance of legislators and of the public of what constitutes proper standards in the treatment of disease. Human anatomy, physiology and pathology are the same no matter what ideas of treatment may be held by various sects. Osteopathy is an untested theory, whose proponents have thus far seemed unwilling to put it to a real scientific test. Christian "Science" is a state of mind which may be perfectly harmless in persons who are not suffering from organic disease, and may even be beneficial to certain types of nervous people, but which is nothing short of disastrous in the presence of organic disease. Chiropractice is, one might be tempted to say, the practice of chiro-mancy, a concoction of sanity and insanity, made up mostly of claims that will not bear unprejudiced investigation.

The development of medicine during the past fifty years has been phenomenal, due to the tremendous advances made in biology, chemistry and physics. The whole trend of modern medicine is toward the greater utilization of the so-called exact sciences in explaining phenomena observed in the living body. The physician of today must know a great deal more of those sciences in order to make intelligent use of them in studying disease and in devising means of counteracting it. However, there is a tendency on the part of many physicians to forget that science is but the means to an end and not the end itself, which is the alleviation of human suffering. The elaborate use of scientific methods of one sort or another must not be overdone. Many of them yield only relative or partial information, which may often be obtained by more simple means. As a result of this tendency the science of physical diagnosis is being neglected. This is particularly true among the younger members of the profession, who, instead of a careful examination of the chest, for instance, immediately decide that an x-ray plate will solve the whole problem. It is the path of least resistance, a path that leads to slipshod work and to the discredit of the profession.

From the point of view of the public, there is no doubt that medical treatment is becoming more and more a luxury. The growing affinity of medicine for science has tremendously increased the cost of treatment. The rich are in position to buy all the science they wish. The very poor, at least in the large cities, receive its benefits without charge. But to the millions in between, this mounting cost is becoming a serious problem. What with special laboratory examinations, hospitalization and the cost of nursing, the public is groaning under a steadily increasing burden. Solution has been attempted; such an attempt is the group system, but it is not proving a complete solution. Certainly there is a crying need for simplification of the procedures and of the medical attitude.

The general practitioner must remain the interpreter of modern scientific doctrine to the public who requires his services. He must make himself familiar with, and utilize in his treatment of patients, such newly acquired facts as have been demonstrated by research; or, if such new methods be too technical for him to utilize himself, he may seek the services of a qualified specialist. There is no reason why modern scientific medicine should be incompatible with a keen sense of sympathy and human understanding. The practitioner of today need not be less human than his namesake of fifty years ago. There is nothing that prevents him from being just as much a man and even better a practitioner, because present day medical training is infinitely superior. The result of such training, however, depends on the character and intelligence of the man himself. "Tel vaut l'homme telle vaut la chose."

A. U. DESJARDINS.

California Installation Requirements

THE Industrial Accident Commission of the State of California, in its proposed revised form of "Electrical Safety Orders" just issued, includes a section entitled "X-ray and High Frequency Apparatus."

For the benefit of subscribers residing in California especially, and for the information of all users of high potential apparatus of this nature, the section referred to is quoted in full:

X-RAY AND HIGH FREQUENCY APPARATUS

Order 284—*Low-Voltage Circuits.*

(a) Wiring. All of the conductors (except those which must necessarily be left exposed) shall be enclosed in metal conduit or metal wireways.

(b) Switch Required. A standard safety type switch shall be installed in the low-voltage circuit to each machine. Each switch shall be located within sight of the machine it controls.

(c) Protective Devices. At the location of the service switch or at the distribution center in each building in which x-ray or other high-frequency apparatus is operated, there shall be installed a standard device which will protect the wiring in the building from high-potential surges and induced currents. This protection may consist of one of the following devices connected between each wire and ground:

1. A mica condenser of not less than one-half microfarad capacity.
2. A resistance rod.
3. An incandescent lamp.
4. An aluminum lightning arrester. (On direct current systems only.)

Dangerous or troublesome currents may be induced in the light and power wiring of buildings in which x-ray or other high frequency apparatus is operated; and high-voltage or high-frequency currents may feed back from such apparatus into the light and power wiring in the building. It is, therefore, necessary, in order to prevent personal and fire hazard from such causes, to provide some device (such as those mentioned in Section c) of this order which will "drain off" from the light and power wiring such dangerous or troublesome currents. Since the ground connection on the secondary system (if it is grounded) may be at some distance from the high-frequency apparatus, each light and power wire entering the building must be connected to ground through a device which will "drain off" such dangerous or troublesome currents. These devices, in order to be effective, must be installed at, or near, the point of entrance of the service. They must be connected at all times or be so arranged that they will be automatically connected at all times when the circuit to the high-frequency apparatus is energized.

Due to the damage which might result to piping systems if the device used on direct-current systems offered comparatively low resistance to this current, it will be necessary on such systems to use a device (such as a mica condenser or aluminum lightning arrester) which offers high resistance to direct current, but low resistance to the high-frequency currents which it is intended to carry off.

Order 285—*High-Voltage Circuits.* (Within the machine case.)

(a) High-voltage parts enclosed in a wooden cabinet of an x-ray machine, shall be insulated sufficiently to prevent a discharge through the wall to the body of a person outside.

Order 286—*High-Voltage Parts.* (Attached to the outside of the case.)

(a) Barriers. Adequate mechanical barriers shall be provided to prevent the operator from approaching within dangerous distance of all high-voltage parts attached to the case (such as spark gap, millimeter, and outgoing wiring). Parts not so protected shall be completely and adequately insulated. It is recommended that glass be used for the mechanical barriers, as it permits of examination during the operation of the machine.

(b) Operating Handles. All operating parts, such as spark gap handles and regulating handles, shall be made of suitable insulating material and shall be operative from the outside of the barriers.

Order 287—*High-Voltage Wiring.* (Outside of the machine case.)

(a) Strength of Overhead System. Overhead high-voltage wiring systems shall be so installed as to withstand a downward strain of fifty pounds.

(b) Height of Overhead System. No overhead high-voltage wires shall be placed at a distance less than eight feet from the floor of the room, and no terminals from cord reels, or other conductors, shall be permitted to hand lower than seven feet, six inches from the floor, except when actually connected and in use.

(c) Guarding High-Voltage Leads. The high-voltage leads on tilting tables and fluoroscopes shall be adequately insulated or so surrounded by barriers that contact with them is impossible. Tube terminals and high-voltage wires leading thereto shall be adequately insulated for a distance of twelve inches from the terminals. Shields for this purpose shall be designed to carry the high-voltage leads away from the patient in a direction at right angles to the long axis of the tube.

(d) Only One High-Voltage Device to Be Connected to Each Source. No arrangement will be permitted which will enable more than one piece of apparatus to be connected to the same high-voltage source at the same time.

Order 288—*Grounding.*

(a) All tube stands and fluoroscopes shall have their frames, operating handles, and all noncurrent-carrying metal parts grounded in conformity with the general grounding orders. For this purpose a flexible stranded cable is preferable to a solid wire which may break or become disconnected. Separate metallic tables shall not be grounded. Nonmetallic tables and chairs are recommended for all x-ray work, particularly in therapy.

Order 289—*High Frequency Machines of the Quenched Gap Type.*

(a) All low-frequency current-carrying parts shall be adequately insulated or protected mechanically so that they can not be touched during operation. This applies to all circuits except the high-frequency circuit proper, which delivers high-frequency current normally for therapeutic purposes.

Order 290—*Transformers.*

(a) Transformers which are a part of x-ray or other high-frequency apparatus, even though they contain oil, are to be considered and treated as a part of the device, and need not be installed as required for light or power transformers.

Order 291—*Ventilation.*

(a) Adequate ventilation shall be provided in x-ray rooms where anaesthetics are administered (owing to the danger of explosion).

A fire extinguisher of the carbon tetrachloride type should be provided in every x-ray room where a high-power transformer is used.

Southern Medical Association Meeting

THE sixteenth annual meeting of the Southern Medical Association will be held at Chattanooga, Tenn., November 13th to 16th, 1922.

The officers of the Section on Radiology are arranging an interesting program. Among other interesting features

will be a joint dinner to be held under the auspices of the Section on Surgery and the Section on Radiology, at which time Dr. George W. Crile of Cleveland, Ohio, and Dr. George W. Holmes of Boston, Mass., will discuss the treatment of hyperthyroidism from the surgical and radiological standpoints.

Visiting radiologists are assured a hearty welcome to all meetings of the Association, and, of course, all Southern radiologists are expected to attend.

THOMAS A. GROOVER.

Scientific Exhibit

THE Detroit Roentgen Ray and Radium Society will arrange a scientific exhibit for the annual meeting that will undoubtedly be the most interesting and comprehensive ever gotten together.

Dr. Preston M. Hickey of the University of Michigan will show a great deal of valuable and educational material.

Those members desiring to add to this important feature of the annual meeting should get in touch immediately with Dr. Rollin H. Stevens of Detroit, who is chairman of the committee and is personally directing the work.

By way of suggestion, this is one of the features of our meetings that has been too much neglected. It can be made well worth while. And under the supervision of the men named, it goes without question that the standard will be set where it should command the whole-hearted approval of every person in attendance.

Dr. Bloodgood's Series

THE interest already manifested in the series of articles upon diseases of the bone contributed by Dr. Joseph Colt Bloodgood of Johns Hopkins, and now running in the Journal, indicates the esteem and respect for Dr. Bloodgood which the profession generally holds, and the importance of the subject under discussion.

From every corner of the United States and Canada, and from men in all the specialties of medicine, come requests for copies. And with Dr. Bloodgood's attempt to contribute something on the subject every month so long as the material at his disposal lasts, it is entirely proper to surmise that the value of the series will become more and more apparent as time progresses. At the present time, Dr. Bloodgood has a fund of information founded on peculiarly significant cases which will without question make this series one of the most valuable and authentic contributions to medical literature.

It is to be hoped that the demands on Dr. Bloodgood's time in his teaching at Johns Hopkins will not prove so arduous that he will find it impossible to continue and complete this important work. It is an effort which lays a great debt on the medical profession, because no other person is quite so fortunately possessed of the data or the ability to do so arduous a task as is Dr. Bloodgood.

More About Technicians

THE response of the society membership in connection with the examination of technicians under the American Registry of Radiological Technicians, has been both inspiring and enlightening.

With about ninety-five per cent of the membership already heard from, only two or three conscientious objectors have been found. The balance, constituting as they do the big majority, not only express themselves unreservedly that this is a proper undertaking, but offer their services, time and money in any wise necessary to insure its success.

Many valuable suggestions have been offered. By way of explanation, it will take a little time to tabulate this wealth of data and get it into accessible and workable shape. Particularly is this true, when it is remembered that the organizational machinery for conducting these examinations involves an inordinate amount of detail which must be resolved into routine before the bureau can function as promptly and as efficiently as it is hoped to make it do.

The technicians themselves seem to be in hearty sympathy with the work undertaken. More than a hundred requests for applications have already been received and the applications mailed. So that it may be reasonably expected that in the not distant future a very substantial nucleus will have been created around which to build a highly effective and reputable organization.

With such a promising beginning, the conclusion seems absolutely sound that the Radiological Society of North America can accomplish much for the betterment of the science and the improvement of the standards of a very willing and loyal corps of assistants, by continuing this undertaking with fitting vision and forethought.

Commercial Exhibit, Annual Meeting

From the interest already manifested, it is safe to assume that the commercial exhibit at the annual meeting of the Radiological Society of North America, to be held in Detroit, December 4th to 8th inclusive, at Hotel Statler, will surpass anything of its kind in the history of the organization.

With all the available space sold and manufacturers and distributors of various appliances and apparatus clamoring that they be given room to show their wares, there is no question but that the capacity of the hotel will be taxed to the limit.

In this connection, it is probably only fair to say that the attendance bids fair to outnumber anything previously of record in the science of radiology. A very comprehensive and instructive scientific program is being arranged, a scientific exhibit to which there has been nothing comparable in the history of the Radiological Society is assured, reduced railroad rates under the identification certificate plan will be in effect, and with the wide recognition that is being accorded radiant energy in its various forms both as a diagnostic aid and therapeutic agent, the meeting is sure to bring together an unusual number of men from all parts of the United States and Canada who are seriously interested in science.

The effort of the exhibitors will be to make their exhibits both interesting and educational. Each exhibit will be in the hands of competent men from whom information can be obtained without any embarrassment.

Exhibitors

Space No. 1—Patterson Screen Co., Towanda, Penn.

Space Nos. 2 and 3—Standard X-ray Co., 1932 N. Burling St., Chicago, Ill.

Space No. 4—Jno. V. Doehren Co., 208 N. Wabash Ave., Chicago, Ill.

Space No. 5—Radium Chemical Co., Marshall Field Annex, Chicago, Ill.

The Radium Chemical Company of Pittsburgh will have on exhibit the latest apparatus used in connection with radium work, and will demonstrate several new methods for handling radium. The present tendency is toward simplicity, and with that end in view, new instruments have been designed to simplify the handling and application of radium.

Following out the custom of having a radium conference in Pittsburgh either before or after all national meetings, we desire to announce that for this meeting the conference will be held from December 11th to 15th, and all members of the Radiological Society are cordially invited to be present.

Space Nos. 6 and 7—James Picker, Inc., 497 Lexington Ave., New York City, N. Y.

Space No. 8—Sagamore Chemical Co., Inc., 213-15 Water St., New York, N. Y.

Space Nos 9, 10 and 11—Engeln Electric Co., 4601-11 Euclid Ave., Cleveland, Ohio.

Space Nos. 12 and 13—Victor X-ray Corp., 236 S. Robey St., Chicago, Ill.

Chief among the apparatus which will be on display will be the new Victor Stabilized Mobile X-ray Unit, a recent Victor achievement, which is radically different from any type of x-ray apparatus heretofore offered to the profession. The three most outstanding features of this new unit are the Stabilizer, Auto-Transformer Control and Circuit Breaker. The merits of the Stabilizer are already apparent to the majority of x-ray users throughout the country. Not only does this device eliminate the disadvantages due to line fluctuations, but it furthermore means a considerable saving in tube and film costs, not to mention the freedom from worry, and the certainty of results which will accrue to the user. The Auto Transformer control furnished with this new unit provides for twenty-six separate control steps, thus giving to the user a refinement of control that is truly ideal. The Circuit Breaker provided with this unit means not only protection to the tube, but also protection to the operator and patient.

Another Victor development which will be on exhibit is an improved type of stereoscope. This new outfit is the result of considerable experimental work by Victor engineers and combines features which make for a stereoscope of the utmost economy, simplicity of operation, beauty of design, and above all, even diffusion of light over the radiographs to be viewed, resulting naturally in more certainty in diagnosis.

The Victor line of Quartz Lamp Equipment will also be on display at the meeting. Both the Water Cooled and Air Cooled Lamps will undoubtedly attract the usual close attention on the part of the medical profession, but in addition there will be on display the new mobile hospital unit, which is designed so as to be conveniently wheeled from room to room.

Those in attendance at the meeting will also wish to carefully inspect the latest type of Victor High Frequency apparatus, a machine of portable construction delivering sufficient current for the treatment of any condition indicating the use of high frequency currents.

Space No. 14—Buck X-ograph Co., 6629 Olive St., Rd., St. Louis, Mo.

This exhibit will consist of a display of X-Ograph Dental Film Packets, X-Ograph Developing and Fixing Chemicals, the X-Ograph Contact Cassette, and X-Ograph Universal Dental Film Mounts, including a dental film mount filing device and film viewer, incorporating a decided departure from the old method of mounting and viewing dental radiographs.

Space No. 15—U. S. Radium Corp., 58 Pine St., New York City, N. Y.

Space Nos. 16 and 17—Liebel Flarsheim Co., 410-16 Home St., Cincinnati, Ohio.

Space No. 18—Sweetbriar Laboratories, Inc., 1220-28 Hodgkiss St., N. S., Pittsburgh, Penn.

This exhibit promises something of unusual interest in the way of work done with the new Sweetbriar screens.

Space Nos. 19 and 20—Waite & Bartlett Mfg. Co., 53 Jackson Ave. Long Island City, N. Y.

Oil Immersed Unit—This comes in a tank 23½ inches long, 12 inches wide, 13 inches high. Mounted in the tank is the high tension transformer and a separate filament current transformer. Above this is placed the lead glass shield and 30 milliampere radiator tube. The unit is ship-

ped having the oil in a separate container. The tube goes in the regular crate. The tube holder, however, is arranged so that it is a very simple matter to put the tube in the lead glass shield and mount it in the tube holder, which is permanently attached to the under part of the cover.

There can be an opening in the top of the box for the x-rays to come through, or it can be placed on the side. It can also be arranged so as to take the same shutter that is used with our fluoroscope.

This unit can be mounted on a carriage under a fluoroscopic table, or it can be mounted between two uprights having a counter-balance adjustable for height.

NEW MODEL RADIOGRAPHIC AND FLUOROSCOPIC TRANSFORMER WITH OIL IMMERSED AUTOMATIC THROW HIGH TENSION SWITCH—This transformer is in a tank 16 inches long, 12 inches wide, 14 inches high. In this tank is mounted a high tension transformer, filament current transformer and double throw automatic high tension switch. There is a double set of high tension terminals coming out of the top. When this is connected with the control cabinet or control panel, the high tension switch is automatically thrown one way or the other, according to whichever foot switch the operator steps on. This does away with having to stop to turn the high tension switch or to even give it any thought. A still greater advantage is that it does away with the oxidation which takes place in the filament circuit of the ordinary exposed high tension switch, causing trouble.

NEW MODEL CONTROL CABINET FOR THIRTY MILLIAMPERE TRANSFORMER—The same equipment, instead of being in cabinet form, the cabinet mounted on a slate base so that it can be readily placed against the wall.

This control cabinet can be used either with the fluoroscopic transformer or with the oil immersed unit. The switchboard or cabinet, contains the following:

Coolidge meter, voltmeter and milliammeter.

Auto-transformer adjustable in two-volt steps.

Adjustable overload circuit breaker with double silver contacts opening both sides of the line.

Automatic current regulator which will keep the milliamperes constant at five or thirty. This is controlled by means of a two-way switch which is marked "Fluoroscopic and X-ray."

Two connections for floor switches to be used either singly or in combination with the fluoroscopic transformer, having an automatic high tension oil switch.

A plug connection for floor foot switch. This is arranged so that it is impossible to use 30 milliamperes except when the switch is on the side which enables you to use the foot time switch. In other words, you cannot possibly turn on 30 milliamperes with the ordinary foot switch.

There is another outlet which can be connected with a red light overhead so that when the foot switch is used the red light automatically goes out.

NEW MODEL G-U MASSACHUSETTS FLUOROSCOPIC AND BUCKY DIAPHRAGM TABLE—This consists of a table having the Bucky Diaphragm permanently attached to it and movable. At one end underneath is placed an oil immersed fluoroscopic unit which is adjustable six inches each way. Attached to the base of the Bucky is an upright which supports the oil immersed unit, arranged so that the rays come out of the bottom of the tank. This is accurately centered over the center of the Bucky so that after the operator has made a fluoroscopic examination, he can, without moving the patient, simply push the Bucky down to the other end of the table under the patient; the Bucky having been previously loaded wiht the film. The control board can be mounted at one end of the table if desired, so as to eliminate all wiring possible.

NEW AND ORIGINAL MODEL STEREOSCOPE—This is mounted on a counterbalanced stand so that the operator can sit down in a comfortable chair in front of it and make his examination without any discomfort.

The illuminating boxes are novel in construction, the curtains being placed inside of them but being adjustable from the outside. This enables the placing of a cross-bar so that the films can be readily held in position without any difficulty.

This apparatus stereoscopes very much easier than the ordinary type owing to the fact that the operator looks directly at one plate with one eye; while the other eye looks at the mirrored surface. It is hard to believe what a very great difference in clearness this arrangement results in.

UNITED STATES ARMY MOBILE UNIT—This is the model such as was made up for the U. S. Army in conjunction with the late Professor John S. Shearer of Cornell University, and represents the result of his experience in France. It has been designed with a view to economy of space without losing the advantages of universal adjustments.

This is in a cabinet 20 inches wide, 24 inches deep, 36 inches high. There is a 35 foot service reel permanently attached in the cabinet to be connected with the electric light service. There is space so that a rotary converter can be used to operate up to ten milliamperes, and mounted in this unit. The sides are all removable, so that every part is accessible.

This is a unit which every hospital should have. It will do all kinds of radiographic and fluoroscopic work. It is, of course, not suited for therapy or for instantaneous work; but it will answer the requirements of any small hospital.

LATEST IMPROVEMENT ON 10 K. W. INTERRUPTERLESS MACHINE FOR ALTERNATING CURRENT—This 10 K. W. Interrupterless Machine has been improved in the following ways:

All makes of alternating current interrupterless machines have polarity indicators; so that when the apparatus is put into operation the operator is supposed to look at the polarity indicator and then turn the pole changer switch one way or the other. If, however, he fails to do this and closes the operating switch, the polarity may be wrong and the possibilities of puncturing a tube are very great.

With this new arrangement, this is all absolutely avoided. It is simply impossible to turn on any high tension unless the polarity is correct. When the machine is started up there is a red light. If this lamp lights up the polarity is wrong. If, however, the operator neglects to pay any attention to it and goes ahead and closes the operating switch, nothing will happen, he simply cannot get any high tension. He will then, of course, look to see what is the matter and notice the red light, which means that the pole changer should be turned in the opposite direction. This device is exceedingly simple and there is nothing whatever to get out of order.

This unit also carries an auxiliary contact. This is for use in making automatic stereoscopic exposures in combination with the new electric-trip stereoscopic tubestand and electric-trip vertical plate changer. In order to do stereoscopic work with the new equipment, it is simply necessary to load the plate changer, place the patient in position, and have the tube in position for the first exposure. The operator then simply closes the operating switch. This will make the first exposure, and the instant it is over the tube will shift and the plate changer will revolve. During this period the time switch will reset itself; and the instant the second plate comes into position the second exposure will be made and cut off.

Space No. 21—French Screen Co., 406 McKerchey Bldg., Detroit, Mich.

Space Nos. 22, 23 and 24—Kelley-Koett Mfg. Co., Inc., Covington, Ky.

Space Nos. 25 and 26—Radium Co. of Colo., Radium Bldg., Denver, Colo.

The Radium Company of Colorado will exhibit a complete line of radium applicators and accessories. In addition to the usual instruments which have been regularly furnished with radium, the equipment shown will include numerous accessories of new designs.

The gold needle with platinum-irridium tip has been discontinued and needles of platinum-irridium or non-corrosive steel, are recommended. Possibly the most interesting development in needle design will be the new short length non-corrosive steel needles containing five milligrams each. These needle applicators, which are exactly one-half the length of the ten milligram needles and identical in external diameter, will be shown with accessories to facilitate application. The advantage in using the short needles of this design in conjunction with the standard long ten milligram needles will be demonstrated, with reference to the adaptability of standard screens.

A slender needle designed to contain three or five milligrams of radium element will also be included. Platinum-iridium needles of sufficient wall thickness to absorb all Beta radiation will illustrate the prevailing tendency in French design of such radium applicators. Brass capsule screens to contain needles have recently been added to the equipment not shown in the company's catalog.

Among new accessories for needles is a new type of needle introducer which has practically eliminated every difficulty in threading. The instrument is designed for imbedding non-corrosive steel needles. It will be shown in six, eight, ten and twelve inch lengths.

Another needle accessory is the flexible needle-holder, designed for use in conjunction with some standard form of operating cystoscope. This special needle introducer is supplied to meet a demand for a simple attachment for any standard instrument to avoid the necessity of duplicating the expensive lens system and other parts of the entire cystoscope. As an operating cystoscope is invariably found in the urologist's armamentarium, the new accessory will probably meet with general approval.

The result of considerable study and co-ordination of ideas obtained from numerous radium therapists will be seen in a new form of oesophageal applicator. The chief advantage claimed is the simplicity of design. The instrument will be shown in various sizes to contain either glass radium-containing tubes or metal needles.

A new form of metal lined carrying case for radium needles will be shown. This case has been designed to accommodate the wires attached to needles, thereby providing a satisfactory container to hold the needles when ready for application. The number of needle compartments is made to meet individual requirements.

Metal-covered plaques in the design of which a marked departure from existing practice has been made, will be shown with records to illustrate the advantage of the new instrument over the older form of composition-covered plaques. The radium in the new flat applicator is distributed directly beneath a very thin layer of Monel metal, which permits the passage of approximately three times as much Beta radiation as escaped through the much thicker layer of composition. These plaques are shipped in new lead-lined carrying cases which will also be included in the equipment shown at the Radium Company of Colorado booths.

Adaptable applicators have been designed to facilitate the application of glass tubes or metal needles in the treatment of skin conditions. Several types of these instruments will be shown, including applicators to hold two glass tubes in separate compartments, and instruments to contain five or more needles. In each instrument the primary applicator is held in position beneath a very thin layer of non-corrosive steel.

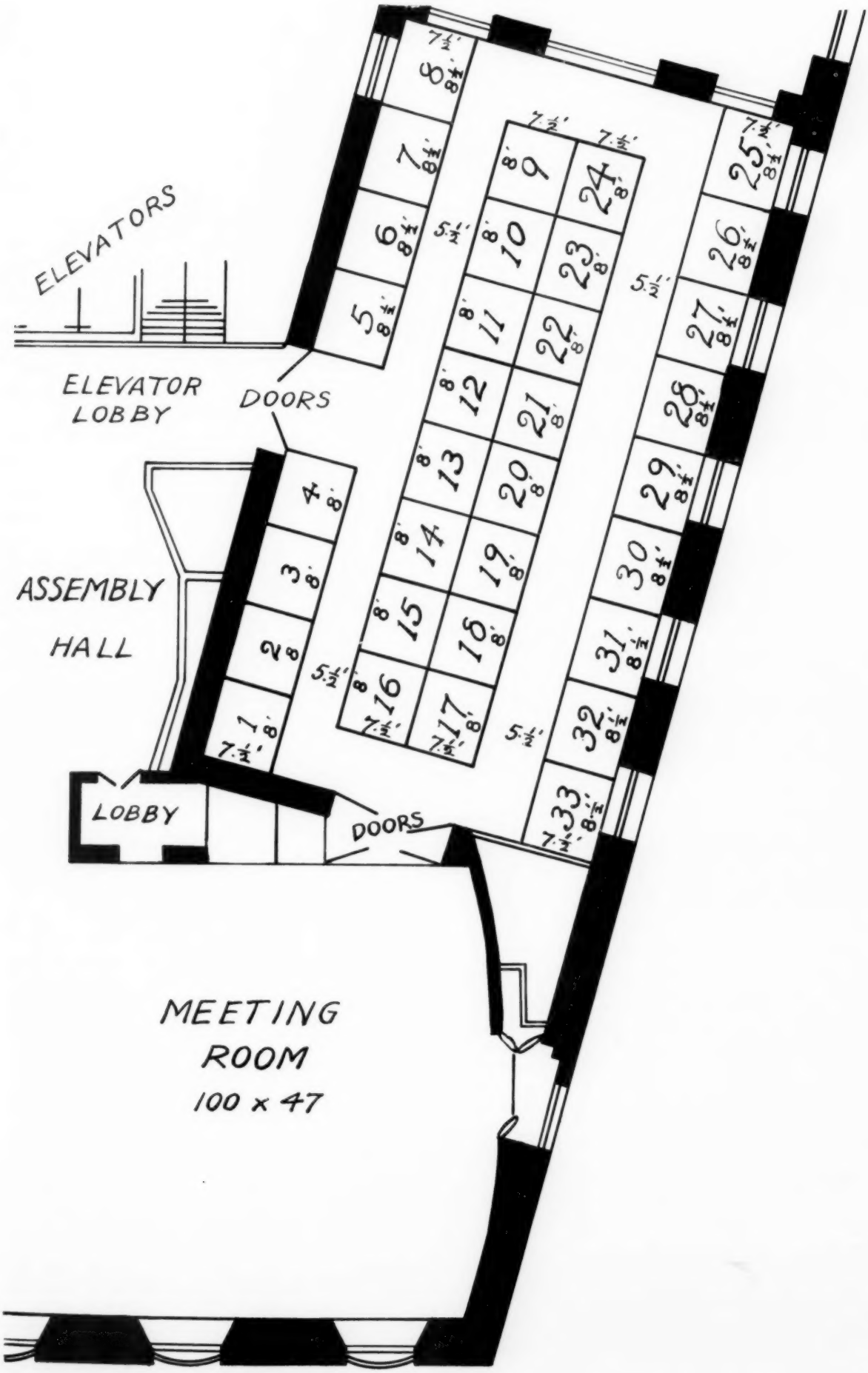
Several forms of very practical distance applicators will be shown, including a special form of eye cup to hold radium tubes or needles at a distance of approximately twenty-five millimeters. The distance applicators and eye cup are supplied with special sheet-metal screens of various thicknesses. A convenient screen of gold-plated brass, moulded to fit the contour of the eye may also be mentioned.

Among the general accessories will be included, Balsa wood for blocking radium away from the skin. It is an extremely light weight wood, highly recommended on account of the ease with which it may be cut to the required shape and also because it absorbs very little gamma radiation. A special grade of Kerr's Dental Compound, Bronze Ligature Wire for radium needles, sheet-lead in various thicknesses and special forms of pure rubber tubing will also be exhibited.

The above mentioned articles are some of the new accessories which, together with the other instruments that the company has regularly furnished its clients, will be demonstrated by representatives, who will be in attendance at booths twenty-five and twenty-six during the entire session of the Radiological Society meeting.

Space Nos. 27, 28 and 29—Acme X-ray Co., 341-51 W. Chicago Ave., Chicago, Ill.

Space Nos. 30, 31, 32 and 33—Wappler Electric Co., 162-84 Harris Ave., Long Island City, N. Y.


ELEVATORS
ELEVATOR LOBBY
DOORS
ASSEMBLY HALL
LOBBY
DOORS
MEETING ROOM
100 x 47

NEW EQUIPMENT

Adaptable Radium Applicators for Surface Treatment

THE equipment furnished by the Radium Company of Colorado includes a new form of radium plaque and instruments designed to hold radium tubes or needles in dermatological applications. Probably the most radical change in design is the departure from the old style varnish or bakelite plaques. The new instrument which has been only recently developed in their laboratories utilizes an extremely thin layer of metal to cover the radium. The entire applicator is made of a non-corrosive alloy, called monel metal, and it may be obtained either in the flat back type without handles are furnished, they are made of the same material. The hexagonal handle may be detached from the small portion and threaded directly into the boss on the back of the plaque but generally if the handles are used at all, the full extension is desirable.

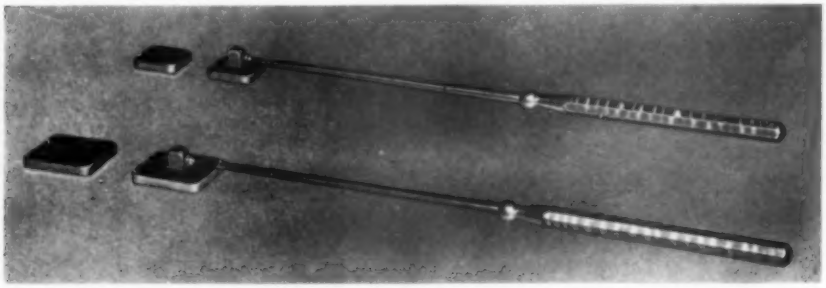


Fig. 1

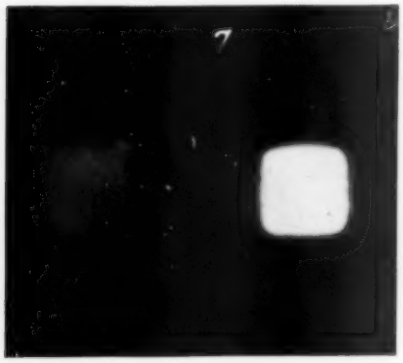


Fig. 2

(Fig. I.) The face of the applicator is made of sheet monel metal only 0.1 mm. in thickness, beneath which the radium is uniformly distributed. The back of the applicator is thick enough to absorb practically all of the beta radiation, thereby providing suitable protection in that direction while the sides of the plaque are of extremely thin monel which allows the beta radiation to escape outward along the entire boundary. It is claimed that this "fringe" of radiation is a distinct advantage in the treatment of large areas requiring several applications. The radiation extending outward from the boundary of the plaque serves to blend the result of one application into that of an adjoining area.

The sheet of monel only 0.1 mm. in thickness has been found to possess the strength necessary to protect the radium but the redmanol formerly employed is not strong enough unless a much thicker layer is used. In spite of the lower density, the thicker layer of redmanol absorbs more of the beta radiation than the very thin layer of monel metal. The intensity of radiation emitted from the new applicator is reported to be nearly three times greater than that of the old style plaque containing the same quantity of radium.

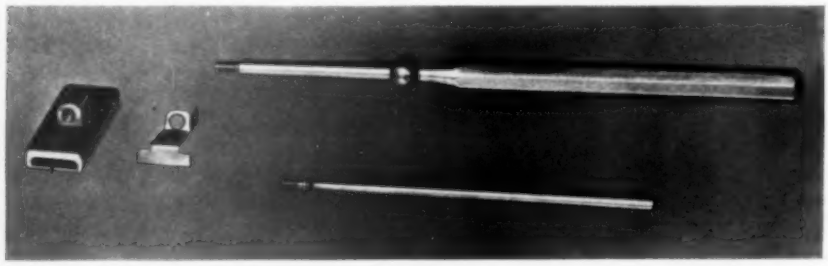


Fig. 4

The difference in intensity is shown very clearly in the accompany illustration (Fig. 2), which was obtained by simultaneously exposing a photographic plate enveloped in opaque black paper to the radiation from the two styles of applicators, the monel plaque producing the more intense image on the right.

Figure 3 illustrates a new instrument designed to contain two glass tubes of radium beneath a thin layer of metal for surface applictaions, including tonsil treatments. The metal face of the plaque is of 0.1 mm. monel metal,

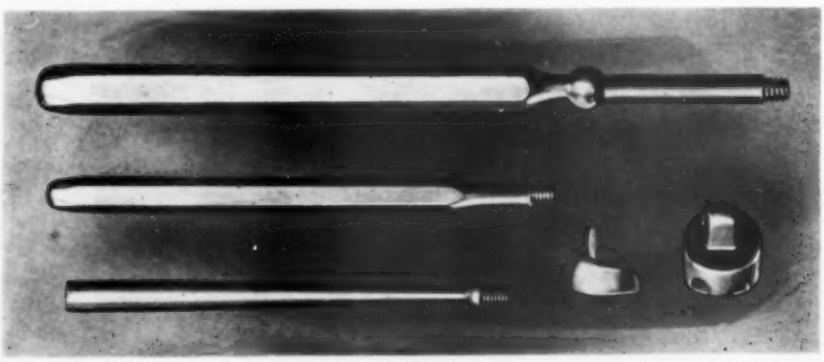


Fig. 3

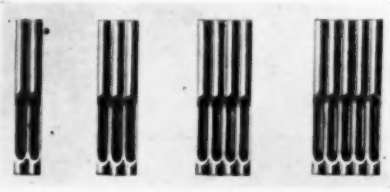


Fig. 5

similar to the applicator above described which therefore permits the operator to utilize the beta radiation with the exception of that absorbed within the glass walls of the tube and the very thin metal sheet. Approximately 50 per cent of the hard beta radiation is available with this amount of filtration. A similar instrument may be used to advantage in combining several radium needles (Fig. 4). The applicator shown in Figure 4 is provided with the same type of metal face beneath which the radium needles may be arranged side by side. A special form of cap which is held in position by the handle serves to retain the needles or tubes in the desired position.

A convenient form of dermatological applicator is illustrated in Figure 5, which contains the usual radium needle in individual fenestrated compartments. The metal is completely cut away on one side of the applicator, directly over that portion of the needle containing the radium. Several needles may therefore be conveniently applied side by side with no metal filter except that of the metal walls of the needles themselves or by simply reversing the applicators, an additional filtration of 0.5 mm. of brass may be obtained.

Time Gauge for Photographic Developing

THE Vulcan Electric Company of Los Angeles, California, has just placed on the market a device known as a Time Gauge for photographic developing.

As will be observed by an examination of the accompanying illustration, taken from the letters patent, the purpose of this device is to measure the temperature of developing solutions in terms of the length of time a plate or film should remain immersed in order to accomplish good results.

The inventor of this instrument, Mr. H. A. Masac, sales manager of the Vulcan Electric Company, makes the statement that the scale of the gauge illustrated is especially adapted to x-ray negatives.

The gauge is illustrated as comprising a base (1) upon which is mounted a closed tube (2) terminating at its lower end in a bulb (3), the tube being positioned lengthwise of the base (1) by suitable brackets (4) and, preferably, being provided with a protecting casing (5) over the bulb (3). The tube and bulb are adapted to contain any suitable medium which is expansible proportional to temperature variations, such as mercury, for example.

Graduations are provided upon the base of the gauge along the tube (2), these graduations being adapted to indicate in terms of periods of time various temperatures indicated by the column of the expansible medium within the tube (2). In the present instance, and as illustrating a practical embodiment of the invention, the graduations shown at (6) may each be arranged to indicate a rise in temperature of one degree F, eleven of such graduations being, preferably, provided forming ten spaces so positioned as to indicate temperature changes from 60° to 70° F.

Each of these graduations is marked to represent a period of time comprising twenty seconds between adjacent graduations, the indications for this period of time starting at three minutes and twenty seconds for the uppermost graduation which represents a temperature of 70° and extending downwardly therefrom to the lowermost graduation representing six minutes and forty seconds. The minutes represented by the graduations (6) are, preferably, marked upon the base of the gauge at said graduations at one side of the tube (2), and the seconds indicated by the graduation are, preferably, marked upon the base of the gauge at the opposite side of the tube (2).

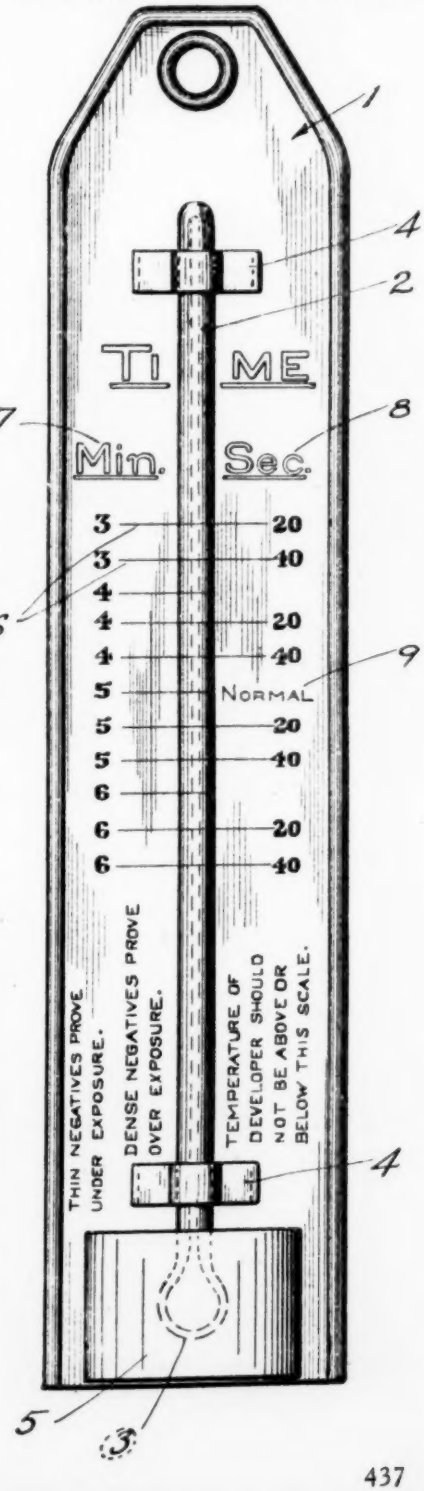
Above the numerals representing the minute graduations the word "Minutes" or an abbreviation thereof is, preferably, marked upon the base of the gauge as shown (7), and similarly the word "Seconds" or an abbreviation thereof is marked upon the base of the gauge as shown (8) above the numerals representing the second graduations. The middle graduation of the series indicating a temperature of 65° F. and marked to indicate five minutes is, preferably, also marked with the word "Normal" as shown (9).

In use the gauge, as thus constructed, is adapted to be inserted in a developing solution which is to be employed for developing photographic plates, in the present instance x-ray plates. The temperature of the solution should always be between 60° and 70° F. inclusive and will therefore be registered on the gauge, and the length of time which a plate should be left in the developing solution will be indicated by the rising column of mercury upon the graduations of the gauge; the length of time which a plate should be left in the developing solution increasing conversely to the temperature of the solution from a period of time of three minutes and twenty seconds for a solution at a temperature of 70° F. to a period of time of six minutes and forty seconds for a solution at a temperature of 60° F. Thus, it will be seen that the proper length of time for developing a plate will be instantly shown upon the gauge when the latter is dipped in the developing solution without necessitating any computations.

Various changes may be made without departing from the spirit of the invention as claimed.

What is claimed is:

A gauge comprising a temperature responsive medium having a scale associated therewith and graduated from six minutes and forty seconds to three minutes and twenty seconds throughout what corresponds to a temperature increase from 60° to 70° F. inclusive.



The New Victor Stabilized Mobile X-Ray Unit

NUMEROUS requests have been made of all manufacturers of apparatus for stabilized units of one kind and another, each with a particular range of service.

The Victor X-ray Corporation believes it has achieved a unit which will meet these demands. It differs quite radically from other similar apparatus, primarily in that the stabilizer is incorporated in the unit as an integral part of its construction and added to this are such special features as circuit breaker, refined control, etc.

The range of service offered in this unit is readily comprehended when it is explained that it is designed to energize the "Radiator" type Coolidge Tube of 30 ma. capacity at a five-inch back-up spark.

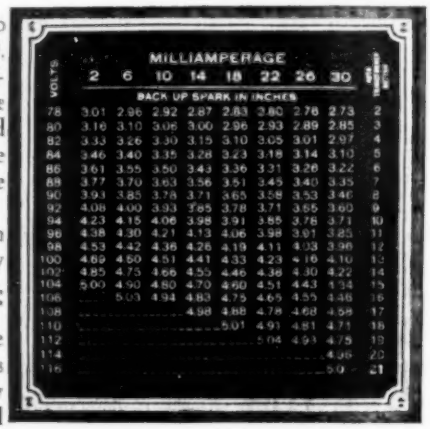
Practically every electric current supply line is subject to voltage fluctuations, to some degree, according to the varying demands on the supply service every hour of the day. Every voltage fluctuation on the line has a corresponding effect on the operation of the Coolidge tube when the current in the latter is regulated simply through the ordinary filament control. Tests show that a 10 per cent change in filament current will cause a 200 per cent change in the current at the tube; obviously, then, a slight fluctuation in the line supply during operation of the Coolidge Tube will seriously affect the end results, unless some intermediary device is introduced to compensate for this voltage fluctuation. The Victor-Kearsley Stabilizer does just that.

This device enables the operator to select the tube milliamperage desired, and once the setting is made, this milliamperage—no more, no less—will be held constant during the entire period of exposure, regardless of voltage fluctuations which may be taking place on the line.

Summed up, the Victor Corporation announces that this unit is an absolutely dependable means of conserving time, energy and the expense of "re-takes." Predicated on the proposition that the operator's radiographic technique is correct, the stabilizer is the one and only insurance of obtaining the desired end result, that is, a radiograph of good diagnostic value.

The circuit breaker incorporated in this unit is developed to a high degree of efficiency. In case of "overload," that is, beyond the capacity of the tube, or short circuit or ground, the circuit breaker automatically shuts off the current from the supply line, and so protects both the tube and the apparatus against damage which might otherwise result.

This device is important from the standpoint of protection to both operator and patient, in case of accidental contact with the high tension system.



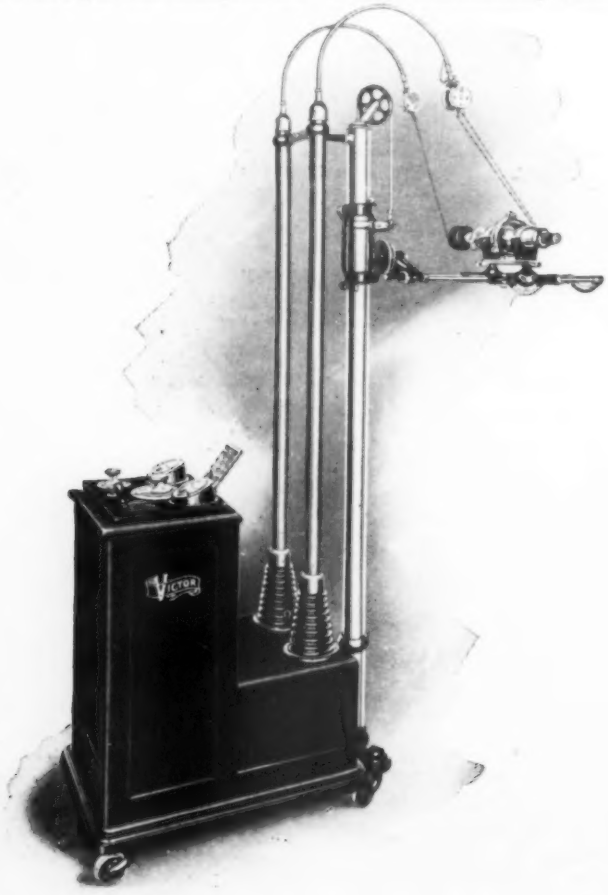
The Victor Unit offers a refinement of control that makes operation comparatively simple.

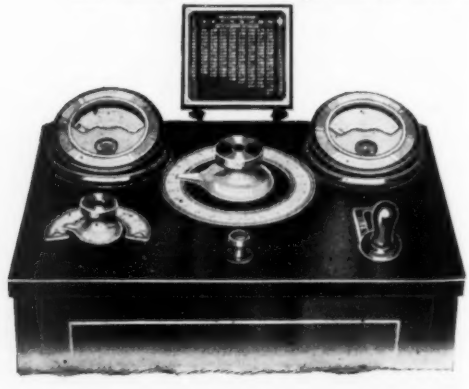
In the first place, the auto-transformer permits the selection *through one lever*, of any back-up spark over a range of three to five inches. This two-inch range is divided into twenty-six steps of penetration providing for the most exacting requirements of control.

The tube milliamperage is also under absolute control of the operator; simply by setting the stabilizer to any required milliamperage, from two to thirty, insures that exact milliamperage throughout the full period that the tube is being energized.

By means of the table mounted on the control stand the operator can determine instantly the voltage and reading and auto-transformer button required to obtain a given penetration and milliamperage.

The milliamperage chart readily conveys an idea of the practical design of this outfit, with the high tension trans-





former, filament transformer, stabilizer, and tube stand all in one unit. This compactness serves ideally where the physician is confronted with the problem of limited space. Hospitals will find the apparatus applicable in many ways—as it is mounted on casters and is easily moved around to any part of the building for use at the bedside or in the operating room.

Another Wappler Combination

THE principal adopted by the Wappler Electric Company in the construction of the component parts of accessory apparatus is proving successful. This makes possible the assembling of various combinations for different purposes.

In applying this principle to the new Wappler Junior Horizontal Fluoroscope of which a description was given in the August issue of the Journal of Radiology, it was found very easy to attach a tubestand and a pair of high tension masts to the table. In this way there was an absolute high tension proof horizontal fluoroscopic and radiographic table. By simply moving the transformer to the head end of the table and changing the connections from the fluoroscopic tube to the high tension masts which connect to the tube in the tubestand above the table, the unit is ready for radiographic work. The transformer is of sufficient capacity to energize the 30 ma. tube and if desired a vertical plate changer either for stereoscopic chest work or stereoscopic work of the colon can be incorporated in the table. The screen arm is easily removed or can be turned sidewise so that it does not interfere with the manipulation of the patient. The tubestand slides along the entire length of the table and has all the flexible features of the Wappler counterbalanced tubestands which run on roller bearings.

This unit should prove very valuable in surgery for alternate examinations by fluoroscope. A few simple adjustments enable the operator to change from one method of examination to the other, and radiographs can be made rapidly and easily. The apparatus can be manipulated by any one and special training in radiography is not required.

Another feature of importance is that it is impossible for any bystander to sustain high tension shocks which sometimes happens when clinicians are making fluoroscopic examinations and unconsciously come in contact with high tension current carrying parts of the apparatus.

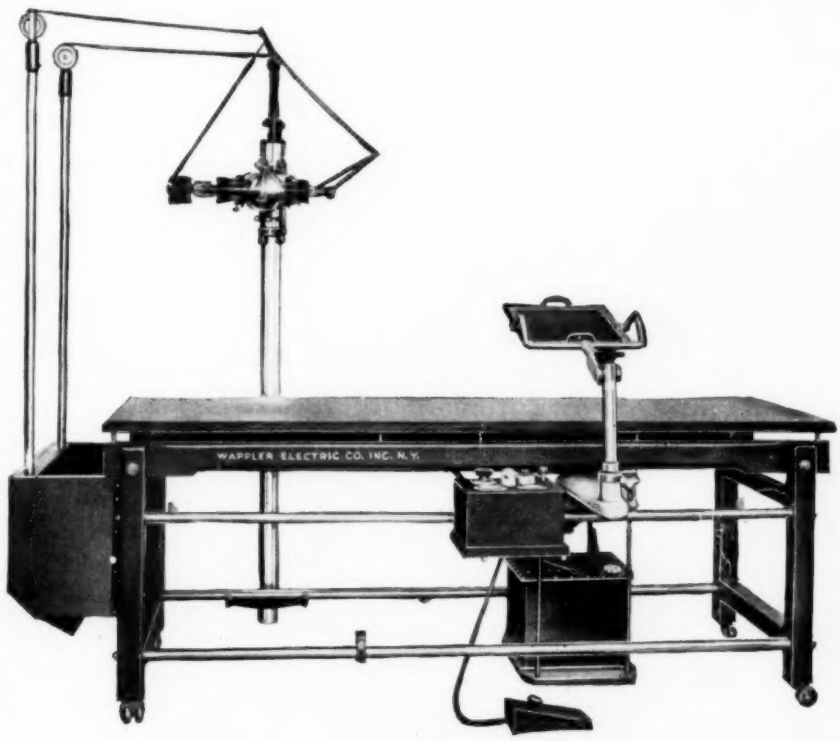
As an apparatus, particularly adapted to use in the operating room and in surgical operations, this table has the valuable feature that a fluoroscopic examination can be extended over the entire body of the patient without the necessity of moving the patient. This is very often of great importance in cases of adjusting fractures or searching for foreign bodies. Thus, when the surgical operation is to be continued the fluoroscope screen is simply pushed out of the field and the operation resumed. If further fluoroscopic or radiographic examination is necessary, then with one motion of the hand either the fluoroscopic or the radiographic apparatus is placed back in position and another film can be exposed or the fluoroscopic examination and direct visible observation repeated.

Particularly distinctive features of this table are:

First: Extreme ease in changing from radiographic to fluoroscopic examinations.

Second: The entire length of the table is available for both radiographic and fluoroscopic examination of the patient.

Third: The absolute safety and extreme simplicity of operation of this apparatus render it very adaptable as a clinical or surgical radiographic and fluoroscopic unit.



ABSTRACTS and REVIEWS

The Value and Limitations of Roentgen Ray Diagnosis. Ernest H. Gaither, M. D., Jour. A.M.A., 79:618, August 19, 1922.

THE writer states that his experience of many years standing is the basis upon which he has written this paper.

He claims that in certain types of pathology of the esophagus, stomach, gall-bladder, liver, and intestines diagnosis without the roentgen ray is impossible; in other types it is merely confirmatory, and in certain others it is useless. He charges that many times it is absolutely mistaken. Because in his past experience he has too often found the x-ray findings mistaken, after he had accepted them against his better clinical judgment, he has now adopted a "more conservative and independent attitude."

In conclusion he says, "The ideas here presented are based entirely on personal experience and observation. I am not by any means decrying the use of the roentgen ray in the diagnosis of digestive disease, and my statements are not prompted by any condemnatory or critical spirit. In all fairness I must pay tribute to the splendid value and proved merit of this method of investigation. I desire, however, to caution the internist against the rapidly increasing habit of deferring his diagnosis until he has received the report of the roentgenologist. This endeavor to shift his responsibility to the shoulders of the radiologist bespeaks a spirit of unfairness, a shirking of duty, which augurs ill for the future of internal medicine. In this, as in all other fields of human endeavor, the best and most accurate results are to be obtained through cooperation."

The following points were brought out in the discussion by Drs. Mills, White, LeWald, Brown, Kessler, and Portis: Gastro-intestinal roentgen ray work is a highly skilled and difficult art, so far attained only by those few who have access to large material. Just as there has been a tendency to overestimate the value of the roentgen ray there is apt now to develop a tendency to underestimate it. Incompetent workers, both commercial and professional, have done much harm and some method of controlling this evil is necessary.

Under certain circumstances (e. g., in one of the St. Louis hospitals) exposures are made by the engineer and interpreted by the nurse-technician or a physician with no special training or experience.

The x-ray diagnosis is not objective, but is a subjective interpretation of objective shadows. It is not the last word in diagnosis, but only one means of diagnosis to be considered in connection with other means. Roentgen ray diagnosis is often mistaken, but so is clinical diagnosis. Nearly every speaker insisted that the roentgen ray diagnosis must not be considered the ultimate dictum, but must be taken into consideration with other findings and that cooperation was necessary to the best results.

ERRATUM

IN the June issue of the Journal occurs an error in the abstract of the article, "Pneumoperitoneum" by Dr. Charles Martin of Dallas, Texas. Dr. Martin is said to have stated that Dr. Orndoff began the use of this procedure about 1917, and Drs. Stewart and Stein in 1919. The portion of this statement referring to Dr. Orndoff was not made by the author, but was inserted by the abstracter.

This correction is made at the request of the author.

W. W. W.

Roentgenology and Internal Medicine. Lewellys F. Barker, M.D., Am. J. Roentgenol. 9:425, July 1922.

HIGH tribute is paid in this paper to the services rendered the internist by the roentgenologist. These two are the "draught horses" in the "modern diagnostic team."

The respiratory, surgical and digestive apparatus, the urogenital, locomotor, nervous and endocrine systems are the topics discussed under specific aid rendered by x-rays.

Speaking generally the author says that the roentgenologist who reports both the objective description of findings as well as their interpretation is the one who renders greatest service to the internist. The highest type of internist greatly desires this and both he and the roentgenologist will grow more rapidly in knowledge and diagnostic ability if such a course is pursued.

The writer states that more intensive and specialized studies are being made by roentgenologists but he stresses the great need for original research directed toward an improved technique and a more accurate interpretation of findings. Clinical studies, observation at operations, and checking up at postmortem should be part of the roentgenologist's program and in large centers roentgenologists should derive great benefit and contribute much to their science if they would organize in groups for original research.

Large hospitals and the universities should have a better understanding of the problems of the roentgenological department. Too often adequate funds are not provided for its use and frequently this department is expected not only to finance itself but to aid the other departments in their finances.

In the discussion following the reading of this paper Dr. Hickey expressed the gratitude of the roentgenologists for Dr. Barker's understanding, appreciation and cooperative spirit. Dr. Hickey said that many mistakes of the roentgenologist can be attributed to his being overcrowded — "The telephone rings for the diagnosis before they have finished the last part of the routine." On the other hand, the internist examines and re-examines his patients with no questions asked.

Dr. Christie said that it was important for both roentgenologist and internist to have a clear understanding of the limitations of roentgenology. The immense field which it covers can be adequately and creditably handled only if each follows some special branch.

Dr. Holmes emphasized the need of careful description and a better vocabulary in roentgenological work.

Dr. Barker in his closing remarks said that the internist was learning not to expect the impossible. Also he said that for an internist not to clearly recognize the difference between a roentgenologist and a picture taker was no longer excusable. There is need for both the general roentgenologist and the specialist in roentgenology according to Dr. Barker's views. Neither one he believes can be dispensed with.

Standardization of Roentgen Ray Reports. P. M. Hickey, M.D., Am. J. Roentgenol. 9:422, July 1922.

THE NEED for standardizing the matter of roentgen ray reports was brought very vividly to the author's attention upon his listening to reports recently submitted at a surgical congress. In order to ascertain the general character of roentgen ray reports he collected from members of the American

Roentgen Ray Society reports upon the examination of various parts of the body. His conclusions are embodied below. He wishes it distinctly understood that he is not criticising the diagnosis made, as their accuracy compared well with the pathological reports.

The roentgen ray report, viewed from the standpoint of form and accurate description is generally inferior to the pathologist's report. This the author attributes to the present inferior and inadequate methods of studying roentgenology in vogue in our medical schools.

The reports are too often lacking in scientific information of value to the surgeon or clinician and in many cases reports contain quite irrelevant matter, e. g., advice as to the treatment of a tuberculous patient. The lack of a standardized nomenclature also is a great detriment.

The author recommends that:

(1) "The American Roentgen Ray Society should make an effort to secure more uniform and better roentgenological courses in the medical colleges of the United States. (2) The American Roentgen Ray Society should recommend a standardized nomenclature to be used in writing roentgenological reports. (3) The American Roentgen Ray Society should foster a standardized type of roentgen-ray reports in the examination of different parts of the body for definite conditions. (4) The American Roentgen Ray Society should require of its candidates the submitting of one hundred roentgenological reports of actual cases written in conformity with the standardized nomenclature and recommended standardized form."

The X-ray Department of a Private Hospital. S. C. Barrow, M.D. Hospital Progress 3:324, August, 1922.

NO HOSPITAL today is properly equipped unless it possesses an x-ray laboratory manned by a competent chief.

For proper equipment modern apparatus for radiography, fluoroscopy, and radiotherapy are prime requisites. The apparatus must be suitably roomed from the standpoint of convenience and hygiene. The x-ray rooms should be on the same floor with and easily accessible to the surgical operating rooms.

The chief should be a radiologist and by this is meant not a mere technician but one who has graduated from a medical school of recognized standing, has practiced medicine at least two years, and has by special study and apprenticeship attained a reasonable efficiency in x-ray work. Nothing short of these qualifications in the chief of the x-ray department is to the interest of any hospital. The employment of a cheap worker is both pernicious and unethical. X-ray interpretation is a specialty and cannot be mastered by a busy general practitioner or specialist in some other line, and much less can it be mastered by an incompetent medical man or one unqualified by medical training.

The x-ray department should occupy and fill a definite position in the hospital. With a properly qualified chief he, and no other member of the staff, is the one whose interpretation is to be accepted. The writer asserts that in nearly every case where x-ray findings are proved incorrect at operation investigation will reveal the fact that either the findings were made by an incompetent worker in the x-ray field or else that the surgeon or some other member of the staff has used his own interpretation of the plate instead of the one given him by the roentgenologist.

Cordial cooperation should exist between the x-ray department and the staff and if it is lacking no progress can be made. If the good of the patient and the advancement of science are matters of paramount importance to each worker then cooperation will naturally ensue. The radiologist should have the time and opportunity to be present at any operation which may be of interest to him and which may shed light on his work, and a little forethought on the part of the staff will result in his having time to work unhurriedly, which is a necessary factor in attaining the best results. It is suggested that a system of reporting operative, pathologic and x-ray findings would be found helpful. The first two should be checked with the x-ray findings, and discussion of these in staff meetings from time to time would be found profitable.

As to the ethical business arrangement between hospital and x-ray chief it should be the same as that between the hospital and surgical chief or other chief of any department. The fee for radiological service should be adjusted between the patient and the radiologist, and fee splitting with the hospital should have no place in the arrangement of the x-ray service.

Graduate Instruction in Roentgenology. J. S. Shearer, Ph.D., Am. J. Roentgenol. 9:459, August, 1922.

"MERE observation will never fit men properly for work in roentgenology or in any other specialty." Instruction in the science of roentgenology, Dr. Shearer believed, should be given the medical undergraduate, though in order to give it some elimination would have to take place along some line, as the medical curriculum is overcrowded at the present time. In some way, however, if the aspiring roentgenologist is to become a worthy member of the profession he must acquire a "general knowledge of normal roentgen-ray anatomy, a clear idea of the diseases in which roentgenization is likely to be of diagnostic or therapeutic aid, and some familiarity with negatives showing indisputable proof of pathology; but all this without wasting time in the effort to make roentgenologists of inexperienced medical students.

"The graduate intending to specialize in the use of this method should be provided with the opportunity to secure: (1) A knowledge of apparatus sufficient to enable him to judge of its necessity and worth. (2) Such knowledge of dark-room work as will prevent domination by a photographer or technician. (3) A clear cut knowledge of other methods of diagnosis in the lesions within his field. (4) As much gross pathology as can be secured. (5) Enough familiarity with operative surgery to enable him to know what information the surgeon needs, and the proper mode of expression. (6) Some familiarity with the main features of the historical development of his specialty. (7) Ability to judge of the relative importance of indications. (8) Such familiarity with the physical laws underlying the subject as will prevent him from publishing irrational papers or accepting them from others."

Instruction by salesmen of x-ray apparatus is an encroachment on the field of medicine that should never have been tolerated but has, instead of meeting disapproval, been welcomed all too often. Commercialism and the immorality of salesmanship is heavily scathed. "The law may forbid a layman to practice medicine but there is no bar to his undertaking to tell the doctor how dangerous agents should be used, or what is the dosage to be given. * * * Both the profession and those responsible for medical education owe it to themselves and to the public to find a remedy. * * * 'Free service' is a most expensive luxury. It must be charged to overhead or selling expense and some one foots the bill. The amount paid in this way would more than support proper instruction and provide for research."

The aggressive technician, unaware of his limitations, is another weight impeding the progress of the science of roentgenology. The writer believed the licensing of technicians to be es-

sentially bad. "A state license is a dangerous tool in the hands of a small class, and gives no real guarantee of fitness. The only remedy effective against such conditions is in provision of such adequate means of instruction as will replace those of objectionable character."

Medical colleges, hospitals, roentgenologists, and possibly a special institute, must undertake the work of educating the coming roentgenologists if the science is to develop as it should and if it is to hold the honorable place to which its services, rightly rendered, entitle it. The intent to instruct must be dominant in the plan else it will be valueless.

Roentgenologists, even though they do not actually teach, can render great service by upholding the highest ideals of their profession and by at least urging instruction and research. Journals and society meetings can also lend their aid along this educational line. Atlases of normals of various ages and of well defined lesions should be available to the younger men just beginning their specialty. There is a largely uncultivated field here for service. Finally there should be a combined teaching and research institution where all problems of research might be worked out. The science of roentgenology is only in its infancy and a great and honorable work is yet to be accomplished in establishing its truths—a work which America might well be proud to lead and which she could lead if she would set herself to the task.

Graduate Instruction in Roentgenology. G. W. Holmes, M.D., Am. J. Roentgenol. 9:465, August, 1922.

YOUNG men aspiring to enter the specialty of roentgenology should have special courses in physics, pathology, and anatomy as well as actual experience in the examination and study of cases roentgenologically, clinically and in the laboratory. In addition they should become familiar with roentgenological literature. Some special subject for study should be assigned and a thesis required. At least a year should be given to this special study although the author adds: "I realize that it is impossible properly to train a roentgenologist in one year's time. On the other hand, very few men, after their college and medical courses with a year or more of hospital training, can afford more than this period of time without a salary. As far as possible men graduating from such courses should be placed in positions as paid assistants to older men, from which positions, after a period of five years, they should be prepared to take charge of a large laboratory or teaching clinic."

Shorter courses than the above are given (at the Massachusetts General Hospital) for general practitioners, not recent graduates, who wish to make some use of the x-ray in their work but who do not expect to make a specialty of it. Often the specialist in some other branch of medicine wishes to avail himself of such a course.

The Effects of Roentgen Rays and Radioactive Substances on Living Cells and Tissues. Leo Loeb, M. D., Am. J. Roentgenol. 9:497, August, 1922.

THE MORE important effects of roentgen rays and radioactive substances on living matter are: (1) There are intrinsic sources of radioactivity within the body. (2) The chief factors determining the degree of sensitiveness of living matter to radiation are given as follows: (a) Actively dividing cells are considerably more sensitive than resting cells and tissues. (b) Cells or tissues consisting of simple protoplasmic material in which a nucleus is embedded are much more sensitive than cells which are embedded in a large amount of transformed cell protoplasm or in products of cell secretion, fibers and paraplastic material in general. (c) Especially resistant are entirely resting cells or tissues, especially if they have been dehydrated. (d) Tissues which are generally more resistant to all kinds of injury are likewise usually more resistant to radiation. (3) Radiation affects cytoplasm as well as nucleus. (4) There is a graded series of effects of radiation on cell functioning. The most delicate and intricate functions are affected by the smallest quantity of radiation. The coarser functions require larger doses. (5) According to the intensity of the radiation we may further grade the action of the rays. * * * Growth processes especially lend themselves to further differentiations of the actions of radiation. (6) These graded effects on growth are not peculiar to the action of roentgen rays and of alpha, beta and gamma rays. (Heat is here given by the author as an example of an agent producing a similar effect on tumor cells). (7) The intensity of radiation which is required for these graded effects varies with the sensitiveness of the cells and tissues upon which it acts. (8) A summation may take place between the effects of radiation and of unfavorable factors within the cell. This summation may convert an otherwise stimulating dose into a depressing one, or it may convert an otherwise depressing dose into a destructive one. (9) In the case of certain effects of radiation, a latent period separates the time of application of the rays and that of the appearance of the first manifest consequences. (10) The effect of the various kinds of rays does not differ in a way corresponding with their fundamental physical differences * * * essentially the difference between the effects of the various rays is of a quantitative nature. (11) There are indications that through repeated radiations an immunization of tissues against the effect of radiation can take place." (12) Here the author states that everything so far said about tissues in general applies equally in the case of cancers which are especially vulnerable because they are dividing rapidly, often under abnormal conditions, and this rapid multiplication prevents or retards the production of paraplastic structures in the tumor which would tend to protect the cells. (13) "The effect of radiation on tumors is primarily a direct one, acting on the tumor cells themselves. Only secondarily do the ingrowth of connective tissue and increased fibroids come into play. (14) There exist certain other indirect effects of radiation which may have to be considered in estimating the influence of radiation on tumors." Here the author discusses the increased and diminished number of lymphocytes in connection with x-ray effects. (15) "In appraising the effects of radiation on tumors we must, therefore, take into account the indirect effects of radiation which depend upon reactions of the host tissue against the tumor, as well as the direct effects on the tumor cells; among the former the connective tissue reactions are probably of the greatest importance. Lymphocytes may play a certain role. It is furthermore possible that as the result of radiation the body fluids may be modified in such a way that growth processes are affected thereby. (16) The toxemia following radiation with a large dose of penetrating rays likewise represents an indirect effect. (17) Long continued stimulating action of roentgen rays and probably also of radium on previously normal tissues may convert these tissues into cancerous tissue, carcinoma or sarcoma."

Radium Therapy in Certain Benign and Malignant Conditions. Drs. Wm. D. James *and* Albert W. James, Southern M. & S., July, 1922.

IN THE treatment of malignant conditions in the several cavities of the body which communicate with the surface, radium is of much greater assistance to the surgeon than is the x-ray. Also on the skin surface, radium is usually preferable.

Of benign conditions, fibroids and fibromyomas of the uterus yield the most pleasing results, except in very

large tumors or pedunculated tumors, which are more amenable to surgery for obvious reasons. Four hundred milligram-hours in the uterine cavity for from four to seven treatments usually suffices for fibroid tumors.

Lupus vulgaris responds more readily to radium treatment than to any other procedure. Full strength radium plaques screened with one or two mm. of aluminum and three mm. of rubber should be used; the same applied to pigmented nevi. Moles should not be treated with radium unless they have become irritated, in which case they should be treated as cancerous.

In inoperable carcinoma of the breast and in recurrent carcinoma after radical operation, radium therapy is the preferable treatment. Heroic treatment over a long period of time is required. Preoperative raying is also advised.

In inoperable carcinoma of the uterus, twenty-four cases have been treated; twelve cases have been discharged for treatment, to be kept under observation; four others are ready to be discharged.

Radium treatment in operable carcinoma of the cervix is a worthy rival of total hysterectomy; two such cases have been treated with clinical cure.

W. W. W.

X-ray and Radium in Superficial Lesions. Byron H. Jackson, M. D., Pennsylvania M. J. 25:707, July, 1922.

IN CANCER every malignant cell should be destroyed with cosmetic effects as a secondary consideration.

Keratoses, corns, warts, papillomas and keratomas can usually be removed in short exposures of full strength applicators.

Vascular nevi yield very readily. Cavernous nevi may be destroyed by careful dosage.

One case of lingua nigre has been successfully treated.

Metastatic nodules from breast cancer are best treated by radium.

In lupus vulgaris radium and x-ray are the two best therapeutic measures, radium being preferred when the lesion is accessible.

W. W. W.

The New Intensive Deep Roentgen Therapy and Its Application in the Treatment of Cancer. J. Henry Schroeder, M. D., Kentucky M. J. 25:463, July, 1922.

THIS paper is a presentation, before a general medical body, of the significance and clinical advantages of the higher voltage therapy by the homogeneous rays of Dessauer, their measurement by the iontoquantimeter, and the therapeutic application of the newer ideas. Certain facts are emphasized:

(1) The complete cancer dose must be administered in as near one treatment as possible. An effective 100 per cent dose cannot be given in fractions.

(2) If cancer cells are not destroyed they will recover from the radiation, and if the dose is less than 40 per cent the cells may be stimulated to further growth.

(3) If too large a dose is administered, the adjoining tissue may be destroyed.

(4) To administer a complete radiation cancer dose may require from two to eight hours constant exposure, and if the patient's condition does not prohibit, this entire dose is given in one treatment.

(5) There is a certain effect upon the blood and Wintz is given as authority for the belief that failure of the blood to recover is the chief reason for failures to cure cancer.

If a full dose is given, it need not be repeated in less than six or eight weeks, as the tissue reactions are hardly completed before this time.

W. W. W.

General Consideration of Radiotherapy. John C. Graham, M. D., Long Island M. J. 16:328, August, 1922.

THIS paper written for the information of those practicing some other specialty or practicing general medicine, gives an unusually clear explanation of the fundamental physics of radium, of its actions on the tissues, and of its therapeutic uses.

A few statements are of special interest to the roentgenologist, for instance, Crile is here quoted as saying that aside from physiological rest surgery and the roentgen rays are the only therapeutic agents of use in thyroid disease. Pre-operative as well as post-operative treatment is advocated.

"Radiotherapy is in its infancy, but it has come to stay, as results may be accomplished with x-ray which can be obtained in no other manner. They do not fulfill the lay idea of a cancer cure, but they are adjuncts in a physician's armamentarium, and as such are of great use in many cases."

Electro-Coagulation Combined with Radiation in the Treatment of Malignant Disease. George E. Pfahler, M. D. *and* Bernard P. Widmann, M. D., Pa. J. Roentgenol. 4:7 (No. 3), July, 1922.

THIS paper was presented about a year after the one of similar title by the same authors (abstracted in the July number of the Journal), and contains additional information.

The disadvantages, as well as the advantages of electro-coagulation are summed up, technique is described, and cases suitable for treatment are described.

The disadvantages are that there is no chance of saving blood vessels or nerves in close proximity to the disease, and the sloughing of tissues with consequent disagreeable odor is, of course, a great objection. The open area left calls for plastic operation for correction. If heat penetrates into the periosteum of neighboring bone, local necrosis of the bone will result, and therefore this must be prevented by curettage of the bone.

The advantages are that there is complete destruction of the local malignant disease by heat, and there is the advantage of greater depth and a larger zone of heat because the heat is generated within the tissues and is not transmitted heat. Neither blood vessels nor lyymphatics are opened and the wound heals with a smooth scar. Less tissue is sacrificed than by surgical treatment.

A general anesthetic is necessary for all but the superficial lesions and presents some difficulty, especially with regard to ether anesthesia, as the spark from the current may cause an explosion and the anesthesia has to be interrupted during the time that the electro-coagulation is in progress. The authors have used hyocine, morphine and cactin in combination, but the same objections hold true here as with morphine. Nitrous oxide is preferred whenever it can be used.

Warts, moles keratoses angiomata and basal cell epitheliomata can usually be cured by electro-coagulation, but sometimes a combination of methods is desirable with these lesions. Epithelioma of the lip and leukoplakia, also carcinoma of the bladder, are first treated by electro-coagulation and this is followed by filtered radiation in the case of the first of these and by radium and radiation from x-rays in the last two. Two exceptional cases of carcinoma of the breast have been successfully treated by electro-coagulation.

Roentgen Ray Treatment of Chronically Infected Tonsils and Adenoids. Charles A. Waters, M. D.; Paul B. MacCready, M. D., and Charles H. Hitchcock, M. D., Johns Hopkins Hospital. Am. J. Roentgenol. 9:469, August, 1922.

TWENTY-ONE cases of infected and hypertrophied tonsils and adenoids were treated with the x-ray to determine whether the same clinical results could be accomplished as in tonsillectomy and adenoidectomy, and to determine whether there was a per-

sistence of the carrier state. The discussion is limited to fourteen of these cases, as the records for the others are incomplete. The following excerpts are taken from the general conclusion reached by this study:

"Roentgenotherapy causes a decrease in the size of chronically infected tonsils and adenoids. * * * Our experience teaches that roentgenotherapy will not cause the hemolytic streptococcus to disappear permanently from the surface of the crypts of the tonsils, but will cause a small percentage of the palpable glands at the angle of the jaw to disappear. * * * Clinically, roentgenotherapy gives relief from symptoms, but this may be only temporary. * * * In some cases the objective signs do not disappear * * * although subjectively they are well. Generalized use of x-rays for treatment of chronically infected tonsils and adenoids is not advisable. Practically 100 per cent of chronic carriers of hemolytic streptococcus and diphtheria can be cured by operative removal of tonsils and adenoids. X-ray and radium treatment must be effective in an approximate percentage, and at the same time more comfortable than operation, and be associated with fewer complications. The x-ray treatment of tonsils and adenoids is especially indicated in those cases where a surgical operation is inadvisable. * * * It is our impression that the greatest field of usefulness will be in the treatment of children. Children rarely have a chronic infection of the tonsils comparable to that of adults. Their tonsils and adenoids are very cellular and of the type that responds most readily to roentgenotherapy. Their symptoms are largely due to hypertrophy of the lymphoid tissue in the throat and nasopharynx. It is possible that when the technique is perfected, roentgen ray or radium treatment will entirely supplant surgical measures in children."

The Present Field for the Use of the X-rays and Radium in the Treatment of Malignant Neoplasms. William S. Stone, M. D., Am. J. Roentgenol. 9:502, August, 1922.

BOTH radiologist and surgeon owe it to their patients to use any help which either branch of medicine may offer to the other. Neither can afford to disregard the other one. Operative treatment of cancer has not been supplanted by radium and x-rays, but its field of applicability has been limited to the earliest stages of the disease.

A review of the more than ten thousand cases of neoplastic disease presented to the author during the last seven years at the Memorial Hospital, New York City, leads him to the conclusion that x-rays and radium have a specific field of applicability.

There are such wide variations in the reaction of tumors of different types as well as of those of the same type that "sarcoma dose" or "carcinoma dose" is not judged an accurate or a scientific term, for no such specific dose exists.

The type of tumor, its size, extent and condition are all factors influencing the effects of radiation. Type and condition are the most important of these. The general state of the patient's health and the condition of neighboring tissues are also important factors.

With the above observations in view x-rays and radium have a specific field of applicability in "lymphosarcoma, metastatic teratoid tumors of the testicle, certain embryonal tumors of the kidney in children and a type of bone sarcoma recently described by Ewing as endothelial myeloma." Operation is rarely indicated in basal cell epithelioma, or rodent ulcer. Lesions of the lip, tongue, mouth, tonsil, larynx, etc., have been brought into the same group for non-surgical treatment during the last three years. Results in uterine cancer are cited as the most brilliant achievements of radium. Results in all other growths of the mucous membranes fall short of those mentioned above.

As to treatment of recurrent lesions Dr. Stone says: "There is the same necessity of early treatment in the early stage as there is in the case of the primary growth. Neither agent is applicable for the terminal period of the disease. It too often happens that instead of receiving morphine and good nursing care, the patient is dragged about in the forlorn hope of being helped by x-rays or radium. Both the surgeon and radiologist are responsible for these abuses."

In cancer of the breast pre-operative raying is much less popular than post-operative raying is, but the author believes it to rest upon a more scientific basis than the latter does.

The use of the x-ray and radium in primary bone sarcoma is in the experimental stage, but substantial progress is looked for here. Results in the malignant osteogenic tumors have been negligible. Giant cell tumors of varying types have yielded both encouraging and disappointing results and conclusions cannot yet be reached.

"The patient's interests are best conserved by obtaining the conjoined knowledge of both the surgeon and the radiologist. In fact, cancer therapy has become an institutional problem requiring more clinical experience and knowledge of surgical pathology to use physical agents than does the operation."

Efficiency in the Diagnosis of Neoplasms. William C. MacCarty, M. D., F. A. C. S., Surg. Gynec. & Obst. 35:209, August, 1922.

HERE are presented the results of a comparative study of pre-operative diagnoses of 2,100 carcinomas of the breast with actual pathologic lesions found at operation and checked by a surgical pathologist at the Mayo Clinic.

Irrespective of malignancy or benignancy the percentage of positive pre-operative clinical diagnoses made was 78.5 of the whole number of cases. This left 21.5 per cent of doubtful or questioned diagnoses. In 50 per cent of these doubtful cases suspicion was expressed.

Classifying the diagnoses with respect to malignancy and benignancy the following data appear: Percentage of positive pre-operative clinical diagnoses of malignancy correct, 94.5. Percentage of doubtful or questioned pre-operative clinical diagnoses of malignancy correct, 62.8. Percentage of positive pre-operative clinical diagnoses of benignancy correct, 82.8. Percentage of doubtful or questioned pre-operative clinical diagnoses of benignancy correct, 81.8.

The writer asks what is the solution in the doubtful cases and answers that it is the surgical pathologist, and that there is no other solution. Such a solution can and should be secured even though there are many possible difficulties in the way, all of which he enumerates and discusses. He does not regard removal of a sector for examination as detrimental.

"All that is lacking to make the diagnostic efficiency greater, in practice, is your encouragement in the making of surgical pathologists with the ideals which have been enumerated. If all surgeons were to spend the next five years trying to follow out the plan presented here we would be able to render the public service of which we might well be proud. If we do not, then we must go along in the same guessing fashion, which I know is not the desire of the majority of the profession. What has been said of the breast is quite as true of the other organs of the body."

The Diagnosis and Treatment of Toxic Goiters. Chas. J. Lemmon, M.D., J. S. Carolina M. A. 18:226, August, 1922.

"IT CANNOT be denied that certain patients improve and apparently recover under x-ray and medical treatment," says the writer but he adds that it is impossible to distinguish between those whom this treatment may benefit and those who should have surgery and that often valuable time is lost by using these agents. Crile is quoted as say-

ing that the greatest number of cures is obtained by surgical treatment.

The following is an excerpt of the author's summary: "Toxic goiters may be present without evident enlargement of the thyroid or eye symptoms" * * * They are frequent and they "may produce a great variety of symptoms often atypical and simulate many other diseases, such as tuberculosis, myocarditis, neurasthenia, menstrual disturbances, etc." * * * "The basal metabolic rate is of greatest importance in the differential diagnosis. Remember Plummer's simple classification of goiters into three classes: (a) colloid; (b) adenomata; (c) exophthalmic. Remember further that colloid goiters occur in young people, rarely persisting beyond the age of 30, are not surgical, and respond to treatment with iodine and thyroxin. Adenomatous goiters rarely give trouble before the age of 30. Advise removal beyond this age. If associated with toxic symptoms advise immediate surgical treatament."

The Value of Basal Metabolism Determinations in the Diagnosis and Treatment of Hyperthyroidism. Henry F. Stoll, M.D., Bost. M. & S. J. 187:128, July 27, 1922.

THE question is sometimes raised whether these determinations are necessary to the diagnosis of hyperthyroidism. Crile, it is said, feels his clinical judgment to be his best guide but not all men have this diagnostic acumen. To most men the borderline cases are very puzzling and clinical judgment by itself is entirely inadequate and unreliable.

The trustworthiness of the basal metabolic test, if it is carefully carried out with the best apparatus, is unquestionable, but careful technique is indispensable and while it is simple, "The simplification of the technique is dangerous when it makes it possible for the tyro to secure measurements, which frequently neither he nor his associates are in a position to interpret intelligently, and from which it is possible for him to draw deductions that are not only erroneous, but since they not infrequently make for or against operative procedure, may actually be of serious harm. * * * Unfortunately the intellectual training of the operator has by no means progressed as rapidly as has the simplification of the technique." (Benedict.)

Roentgen Ray and Tuberculosis in Infants and Children. Frederick W. O'Brien, A.B., M.D. *and* Forrest B. Ames, A.B., M.D., Bost. M. & S. J. 187:279, August 24, 1922

GRIFFIN says: If, therefore, tuberculosis practically always starts in childhood, as we must admit it does by the evidence given us by competent observers, the way to eradicate it is not by sanatorium care of adults, but by preventive care in childhood."

The summary of the author's study is as follows: "We have presented a supplementary group of 34 infants and children, studied from the standpoint of correlating roentgen ray and clinical findings. These 34 cases are added to 44 previously reported. From this new group and total of 78 cases we have found the following:

(1) "A complete total of 20 cases of definite chronic pulmonary tuberculosis in 78 children under 14 years of age, or 24 plus per cent. Ten, or 50 per cent, of these cases were in children under 10 years of age. * * *

(2) "Eight patients were examined in whose lung fields the roentgenogram showed typical markings consistent with pathology caused by tubercle bacilli. These cases were negative clinically. Inasmuch as the prophylaxis of tuberculosis is more and more being begun in childhood, the roentgen ray evidence of pulmonary involvement may safely be taken as a warning, and certain positive cases should receive more detailed attention and treated along preventive lines.

(3) "Ten cases from our old series were re-examined by roentgen ray. These cases were clinically negative, but had shown positive lung field markings in previous roentgenograms. Five from these ten showed changes consistent with progression of the pulmonary condition; two showed development of cardiac lesions.

"From these we conclude that serial roentgenograms should become a routine part of methods of procedure in the diagnosis and preventive treatment of tuberculosis in infants and children."

The Supernumerary Pedal Bones. Morris I. Bierman, B.S., M.D., Am. J. Roentgenol. 9:404, July, 1922.

IT IS only partly true that the tarsus, as is commonly taught, is composed of seven bones. There are in fact about three times this number though this fact is seldom mentioned in anatomies. These added bones used to be considered as sesamoid bones and are often referred to as supernumerary ossicles, which is incorrect.

Research has proved that these bones were once constant structures. They are now lacking in the average foot but are still occasionally found when the center of ossification in the embryo persists as a separate bone. They may have true joints, or a ligamentous attachment but more frequently they fuse with a neighboring bone or else are joined to it by fibrocartilage.

The following outline of the common bones of the tarsus and their accompanying, so-called, supernumerary bones is copied from the original and all but a very few of the bones are illustrated by x-ray pictures:

1. Astragalus: trigonum and the astragalus secondarius.
2. Calcaneus: os sustentaculi and the calcaneum secondarium.
3. Naviculare: tibiale externum, supranaviculare.
4. Cuboideum: cuboideum secondarium.
5. Cuneiforme primum: cuneiforme I bipartitum.
6. Cuneiforme secundum: intercuneiforme.
7. Cuneiforme tertium: os unci (processus uncinatus cuneiformis), intermetatarseum, os vesalianum, os peroneum.

Bone Lesions and Their Treatament. John H. Rishmiller, M. D., F. A. C. S., Journal-Lancet, July 15, 1922.

OUR modern diagnostic facilities, chiefly the x-ray, have so allayed the anxiety of surgeons in treating fractures that many are now just as eager to handle them as they once were to avoid them.

CASES

(1) Surgical neck of humerus: An oblique and impacted fracture, with outer sharp edge of distal fragment projecting through soft tissues. Operation ten days after injury, spiking the head of the bone in proper position. A 25 per cent disability six months after injury and a 12½ per cent disability one year from date of injury.

Radiographs and line drawings show the fracture immediately after injury, and after operation with the arm in aeroplane splint, and again just before operation for removal of the spike.

(2) Sliding inlay bone graft for non-union of tibia: Radiograph showed fracture of tibia four inches from upper articular surface, with displacement of lower fragment outward and backward. Injury on January 17th, with marked ecchymosis and contusion of leg and knee. After failure to unite, radiographs showing callus formation with fracture through the callus, bone graft was made on November 17th. Subsequent radiographs and tracings show the admirable results obtained.

(3) Depressed fracture of cranium and crushed arm: Fell while attempting to board moving train. No radiographs taken prior to operation. The depressed fracture was removed and the traumatic amputation dressed. Subsequent radiographs show the skull where bone was removed and condition of the arm stump.

(4) Open fracture at base of cranium: This fracture extended the lower two-thirds of the distance between the foramen magnum and the superior angle, shown in radiograph and line drawing. The precaution of keeping this patient in recumbent position in bed for two months, although he was apparently ready to be up in two weeks, is held responsible for his excellent recovery.

(5) Fracture of pelvis with rupture of bladder: Heavy timber fell on patient's back while he was lying on the ground. Injured May 25th. After proper surgical treatment of the ruptured bladder, patient was radiographed on June 1st, showing a perpendicular fracture through the posterior portion of ilium, with upward dislocation of the ilium on the sacrum; radiograph and line drawing shown. No attempt was made to reduce the fracture or dislocation.

(6) Strain of ligaments followed by synovitis of sacro-iliac joint: Patient injured on April 19th by fall. On June 1st, he was having severe pain through the lower back. Radiograph showed widening of right joint spaces. With a Goldthwaite belt he made perfect recovery.

(7) Acute metastatic osteomyelitis of tibia from oral sepsis, with radiographs showing the location of the metastatic abscess.

(8) Open fracture of femur, with radiographs showing position of bones and drains, and later radiographs showing extensive callus and strong bony union. W.W.W.

Diagnostic Value of the X-ray in Joint Diseases, with Case Reports. Vernon Blythe, M. D., Kentucky M. J. 20:480, July, 1922.

THE purpose of the paper is to give the x-ray findings, distinctive of the different disease conditions. These are classified into (1) those confining themselves to the articulating surfaces, and (2) those which begin in the articulating surfaces and then extend to the body of the bones.

In the first class there are described, infectious arthritis (acute and chronic in various stages), and the first stages of tuberculosis.

In the second class are described later stages of tuberculosis, destructive conditions following fractures, Charcot's joints and syringomyelia. The signs of hemophilia and Perthes' disease are also discussed.

W. W. W.

Cancer of the Prostate. Hermon C. Bumpus, Jr., M. D., Surg. Gynec. & Obst. 35:177, August, 1922. A comparison of results obtained by radium and surgical treatment.

IN COMPARING results obtained by these two therapeutic agents logical conclusions are seldom arrived at for the reason that the unit of measurement taken is usually the number of patients surviving after a certain number of years, with no reckoning of their comparative general physical condition at the beginning of treatment. Those treated by radium are seldom in as favorable a general condition and therefore the conclusions so often arrived at without consideration of this factor are unjust to radiotherapy.

In a group of these cases studied at the Mayo Clinic there were 72 early cases, i. e., cases in which malignancy was not suspected until operation of a supposedly benign gland revealed it, and also including those operated on because of suspected malignancy. There were 77 advanced cases, i. e., the disease was so far advanced as to render clinical diagnosis certain. Surgical results in these two groups differed only slightly and the mode of operation seemed not to be a factor.

A comparison of all surgical cases (124) with all cases, except metastasizing ones, treated by radium (152) showed, during the first two years, 69 per cent of the surgical group dead and 83 per cent of the radium group dead —a difference of 14 per cent in favor of surgery. It must be noted here that those treated by radium were very poor risks because of their general physical condition while the others were in much better condition. The radium treatment in this group has been given within the last six years, while most of the operative work was done more than six years ago. Furthermore, it is only within the last three years that patients have been wisely selected and adequately treated with radium therapy.

"Formerly it was believed that radium applied over the surface of the prostate either in the rectum or urethra was sufficient, and failure was attributed to inability to penetrate the mucous membrane with sufficiently large doses. To overcome this obstacle, needles containing radium were inserted through the perineum directly into the growth, and large doses were given. This resulted in necrosis and sloughing around the needles, but the periphery of the gland received but scant radiation." It has been found that it is necessary to use all methods of application with minimal doses of radium and the number of points of radiation are as important as the dosage.

The author's conclusions are that: (1) "The results obtained thus far by radium in the treatment of cancer of the prostate are inferior to those obtained by surgery. (2) The new methods of radium application indicate that in the future the results of the two methods will be the same. (3) Partial prostatectomy in cases of carcinoma occasionally proves to be a curative rather than a palliative procedure. (4) A combination of radium and surgery offers the best results."

The Use of Radium in Bleeding from the Non-malignant Uterus. Russell T. Wall, M. D., Pennsylvania M. J. 25:711, July, 1922.

THERE are two kinds of bleeding, one caused by fibroids, and the other by hemorrhagic endometritis.

In fibroids, the indications for surgery in preference to radium are: (1) large tumors; (2) young women where sterilization is not desirable; (3) complicating pregnancy; (4) complicating infection; (5) toxic conditions indicating absorption of necrotic fibroids; (6) where diagnosis of fibroid is not certain; (7) associated surgical conditions.

The advantages of radium are: bleeding stopped at once, no fatalities and no irritating symptoms if precautions are observed, ease of application, no anesthesia, can be given at home if necessary.

In essential bleeding or hemorrhagic endometritis, the effect of radium is prompt and certain. A curettage for diagnosis is essential, as there is always a suspicion of malignancy. Sixteen case histories are given.

Treatment of Carcinoma of the Cervix and Uterus by Radium and Deep X-ray Therapy. Russell H. Boggs, M. D., Pa. J. Roentgenol. 4:5 (No. 3), July, 1922.

IN TREATING these lesions x-ray therapy should be used in conjunction with radium, applying as much radium as the local tissues will tolerate without irreparable damage.

Radium technique calls for knowledge and judgment which will follow only upon careful study. The number of milligram hours used depends upon "the extent of the disease, space in vagina, resistance of normal tissue, filtration, distance apart of needles or tubes" and whether these are buried in or simply applied against the growth.

Properly administered, radium results seem to equal those from hysterectomy in early cases and in borderline

or advanced cases they are superior to those resulting from operation. Inefficient treatment, however, is worse than none at all, but such treatment is all too frequent. Superficial workers are to blame for so many undesirable results. Radium and x-ray are no more mastered in a day than is surgery. The earnest worker is not the one to whom this criticism is directed. Familiarity with the physics of these agents is necessary for their mastery and should, in some way, be obtained.

It is not true, under every condition, that an erythema dose is a lethal cancer dose. The true lethal cancer dose has not yet been established and as yet there is no uniform technique established even in Germany.

Different radiologists differ considerably as to what constitutes an erythema dose—that of Seitz and Wintz is a mere reddening, while that of Warnekros is about twice the Seitz and Wintz dose and is too near the limit of permanent damage to be universally adopted.

The high voltage machine has come to stay, but it is not yet perfected and there is great danger attendant upon its use unless the physician employing it is a physicist or calls in the services of a physicist before attempting to use it.

X-ray Versus Surgery in the Treatment of Fibroid Tumors of the Uterus. Joseph Lane, M. D., Northwest Med. 21:241, August, 1922.

THE percentage of these tumors requiring treatment varies in different clinics from 25 to 90 per cent. Radical treatment is not indicated except when the symptoms are severe, and though some enthusiasts make ridiculous claims it is a fact that with improved technique the counterindications to the use of the x-ray for this lesion are diminishing. In many clinics surgery is now used only when there are counterindications to the use of the x-ray. These are cancer of the cervix or the body of the uterus in addition to the fibroid tumor, pregnancy, and youth or early middle age. Also all cases of ovarian or parovarian tumor, prolapsed uterus or hernia, pedunculated subserous or submucous tumor or a tumor reaching above the umbilicus should be operated upon. In exophthalmic goiter x-ray is also dangerous.

It is important in anemic cases that the clinician should have knowledge of the fact that the x-ray has a powerful effect upon the blood-forming organs and upon the abdominal tissues.

Surgery is counterindicated in nephritis, diabetes, certain neuroses and psychoses, myocarditis, the so-called myoma heart, pulmonary tuberculosis, arteriosclerosis, clorosis, and uterine hemorrhage of syphilitic origin and (by inference) exophthalmic goiter.

Myomectomy for Myomas of the Uterus. William J. Mayo, M. D., Northwest Med. 21:236, August, 1922.

PRESENT technique renders treatment of these tumors one of the best understood and safest procedures of modern surgery.

The menstrual cycle has a marked effect upon the female between puberty and the menopause and the nervous and psychic changes attendant upon the normal menopause are aggravated in young women by an operation which checks the menstrual flow. Whether this is brought about by removing the ovaries and leaving the uterus or vice versa makes no difference in the effects mentioned. Conservation of the ovary or at least a portion of it is of the greatest importance.

The mere presence of a myoma does not necessarily call for treatment. Needless operations are too often performed upon such cases and "many patients with small to moderate sized symptomless myomas are now having radium treatment; such patients require no treatment, but should be under the observation of their physicians." A prudent diagnostician can make a diagnosis of probable malignancy in time for curative operation.

Hysterectomy is seldom necessary for benign myoma in a woman under 35 and should be very, very rarely employed in a woman under 30. After 45 years of age it is probably the best procedure. When it is necessary for uterine myoma the writer believes in a total one. "The common indications for treatment of uterine myomas are hemorrhage, pressure, signs of malignancy and the size of the growth, the form of treatment being determined in a given case by the particular indication present."

As to radium and x-ray he says: "The Mayo Clinic has more than 200 milligrams of radium in use, and its roentgen-ray department is well organized for therapeutic work. Our experience with radium and roentgen-ray has been wide, and we have no prejudices. Roentgen-ray treatment for myomas is capable of producing results somewhat similar to those of radium, but it is less easily controlled and its effects are less direct and certain; the ovaries more than the uterine musculature are affected; with greater possibilities of harmful effect on the intestines and other abdominal viscera by the roentgen-ray. If the patient is approaching the menopause, especially if hemorrhage is the chief indication for treatment, radium gives results so sure and so safe that it has no competitor and its use is indicated in patients whose general condition renders operation more than ordinarily hazardous, such as those with obesity and diabetes. If the patient is near the menopause, and has large tumors, especially if there is associated coincident disease of the ovaries or a suspicion of malignancy, hysterectomy is indicated.

"It has been argued against myomectomy that it is a more dangerous operation than hysterectomy, but the mortality in our series of 909 cases with seven deaths (January 1, 1891, to November 1, 1921), was a trifle under one per cent (0.7). In cases of abdominal myomectomy the mortality was 0.5 per cent. Vaginal myomectomy gave a death rate of 2.7 per cent on account of infection present."

Uterine Hemorrhage of Benign Origin Treated by Irradiation: An analysis of five hundred and twenty-seven cases of myoma uteri and myopathic lesions. John G. Clark, M. D., *and* Floyd Keene, M. D., Jour. A. M. A. 79:546, Aug. 12, 1922.

THE BEST interests of the patient demand that both irradiation and surgery be considered in determining treatment. Radium is, of course, chiefly applicable to these cases in the fourth and fifth decades of life, but with proper precautions it may be successfully used upon younger women.

In cases under twenty years of age it is very important to first exclude every possible contraindication to radium before direct intervention is determined upon. Not only this, but until the patient's health is manifestly deteriorating no form of intervention should be employed, for these cases often tend to self-correction under proper hygienic and medical treatment. If irradiation is employed the initial dosage must be very small and prolonged exposure should not be used. Fifty milligrams for from three to four hours is a safe dose if irradiation is not repeated until at least six months have elapsed. If a second application becomes necessary the time is increased from four to six hours, but not more. In the writers' experience not more than two applications have ever been necessary.

In cases from twenty to thirty-five years of age due consideration must be given to maternal possibilities and to the sexual life. Myomectomy is preferable in all such cases if it is possible. This will interfere with neither of the above functions while there is very little hope of a pregnancy after radiation. A subtotal hysterectomy with preservation of the ovaries is the next procedure of

choice. If radium must be used, then 50 mg. from six to twelve hours is the dosage approved.

After the age of thirty-five the above functions usually call for less consideration though surgical intervention is employed if the patient so wishes. Otherwise the writers' preference is for radium. In cases after the age of forty-five radium "occupies a premier position" for it is effective, gives quick relief, does not incapacitate the patient and no immediate or remote disabling sequelae need be feared. The writers feel that the latter statement is well founded in truth.

The stormy character of the menopause, whether artificial or natural, the writers believe depends more upon the temperamental and nervous stability of the patient than upon age itself.

Of the 527 cases treated by the authors, abnormal bleeding was controlled in 91 per cent of the 476 cases available for statistical study. There was one death which occurred from general peritonitis. A plastic operation upon the vagina, dilation, curettage and an intra-uterine application of 50 mg. of radium had taken place. These procedures were very soon followed by distress in the epigastric region, followed by a general peritonitis. Necropsy was not permitted and the cause of the peritonitis is unaccounted for.

In 23 cases abnormal bleeding was either slight or soon reverted to normal without subsequent treatment. In 28 cases subsequent treatment was necessary. Three per cent of all patients required operation subsequently.

Complications were confined to two cases of phlebitis and eight cases of a more or less severe neuritis. The latter is not unfamiliar in many cases of untreated menopause.

In conclusion the authors say: "We would commit a serious error were we to consider this splendid and most effective plan of treatment as a competitior of surgery. The two go hand in hand, and both must be supervised by the surgeon, and not by the roentgen ray expert or the roentgenologist, for each in a varying degree is a surgical measure."

Ante-Operative Radiation of Carcinoma of the Breast. Russel H. Boggs, M. D., Am. J. Roentgenol. 9:508, August, 1922.

POSTOPERATIVE radiation of carcinoma of the breast does not always yield the hoped for results, but the author believes that pre-operative radiation of these cases would greatly lessen the rate of recurrence. He questions whether operation should extend to the axilla if radiation and radium are employed. Groover, Christie, Merritt, Sittenfield, Quick, Holmes, Hernaman-Johnson and Pfahler are all quoted here in support of the author's judgment.

"The treatment of carcinoma of the breast by imbedding radium throughout the breast and the adjacent glands, *preceded* by surface applications of radium and heavy filtered x-rays makes radiation as thorough as amputation with the most careful glandular dissection. After such radiation removal of the breast may be indicated, but a radical operation may not be necessary."

Dosage and technique are fully discussed in the original paper.

Diagnosis of Early Breast Tumors, Based on Their Clinical Picture or Their Gross and Microscopic Picture at the Exploratory Incision. Joseph Colt Bloodgood, M.D., Bost. M. & S. J. 187:243, August 17, 1922.

DR. BLOODGOOD states that this paper has been presented to at least a dozen audiences and discussions following presentation lead him to emphasize the following conclusions:

1. "Examination should be made without any knowledge of the history or of the breast involved.

2. "Palpation is the essential feature. First to differentiate the indefinite from the definite single lump," and having found the latter to try in every way to recognize any palpable sign of malignancy. In the main discussion it is asserted that "more than ever before is the trained sense of touch required to differentiate between a definite lump, for which immediate operation is indicated, and an indefinite one which is simply part of a lumpy breast. Then when a definite lump is felt, the operator should be anxious to train his sense of touch to distinguish between the benign and the malignant tumor. In some cases this has been impossible."

3. Discusses gross appearance of blue-domed cyst and encapsulated adenoma.

4. Discusses gross appearance of scirrhus and medullary carcinoma, comedoadenoma and colloid cancer.

5. Discusses non-encapsulated areas with or without minute cysts or dilated ducts. "I am inclined to the view, that as surgeons and pathologists learn to recognize the gross and microscopic appearance of the various stages of so-called chronic cystic mastitis as a benign lesion, they will be able to differentiate the nonencapsulated tumor of the benign adenoma type from the same lesion with areas of cancer. * * * Until they are able to do this all lesions should be treated as malignant."

6. Because of the great difficulties inherent in the differentiation of benign from malignant papillomatous the author contemplates a separate communication upon this subject.

7. Recurrence in the scar or its region is due either to bad surgery or late intervention, more often the latter.

8. Earlier intervention and good surgery is necessary if results of surgical operations for cancer of the breast are to be improved. Publicity is the key.

9. "The mistake that should never be made is an incomplete operation for cancer. The operation must never be in two stages.

10. "The mistake that cannot always be avoided is the complete operation for cancer in doubtful cases.

11. "When the surgeons of this country become as good diagnosticians as they are operators, I feel confident that the number of women who lose their breast unnecessarily will be reduced, and the number who are subjected to a complete operation for tumors that are not malignant will also be greatly reduced."

Tumors of the Breast from the Standpoint of the General Practitioner and the General Surgeon. Arthur Dean Bevan, M.D., Illinois M. J. 42:85, August, 1922.

MANY patients who seek the writer's advice for supposed cancer are found upon examination to have nothing that resembles a tumor. These cases call for careful study, nevertheless. The writer charges that many needless operations are performed upon just such cases; sometimes this occurs through an honest mistake and sometimes through unethical practice.

"Tumors of the breast are definite, tangible things, like a bean or an olive or an egg or an English walnut or an apple. It is not necessary to strain one's imagination * * * to determine the presence of a neoplasm if one actually exists."

The technique of the examination and the differentiation of benign and malignant growths from each other and from inflammatory processes is discussed at some length. There are other points to consider but the differentiation of a benign tumor depends largely upon the fact that "a benign tumor of the breast should be movable in the sense that when the mammary gland is held fixed with the thumb and finger a benign tumor can be moved in the mammary gland tissue itself." The usual description of malignancies given in the texts are of little value to any one except the pathologist.

The chronic inflammatory processes which may simulate cancer are actinomycosis, tuberculosis, and syphilis. The first of these is very rare, the second one is easy to differentiate, but syphilis is very deceptive.

The author finds about ten per cent of doubtful cases and in such cases he resorts to sectioning to which he can see no logical objection since "cancer cells do not hop around like the Irishman's flea." Neither does he believe that benign tumors are apt to become malignant in time.

The lymphatic drainage of the breast is described in some detail and the proper surgical technique described.

Permanent cure results in from 50 to 70 per cent of very early cases but in only 25 to 30 per cent when the whole number is taken into account.

These results the writer thinks can be improved by the x-ray of which he says: "I think the x-ray is of very much more value in the after-treatment of breast amputations for carcinoma than radium. I feel personally very strongly that it should be employed in every case, that it should be employed by an expert, and that it should be employed thoroughly, but short of any prospect of burning the patient. Time and again I have seen gross recurrent carcinomatous lesions, the size of a bean or the size of a cherry, disappear under x-ray treatment. It seems perfectly clear to me that if these gross visible, tangible lesions can be made to disappear under the x-ray that the microscopic group of cells from which they sprang could be very much easier destroyed if the x-ray is used immediately after radical operation. * * * And may I emphasize the importance of not only giving patients with cancer of the breast the benefit of proper radical treatment, but of also treating those patients with benign tumors not by radical but by conservative methods."

Histopathology of Cerebral Carcinoma. G. B. Hassin, M.D., *and* H. Douglas Singer, M.D., M.R.C.P., Arch. Neurol. & Phychiat. 8:155, August, 1922.

THE conclusions as set forth by the authors are: "(1) The brain lesions caused by carcinomatous growth are both focal and diffuse. (2) The focal lesions are due to direct invasion by carcinoma cells. The diffuse lesions are of the type of a toxic (non-infiltrative) encephalitis. (3) Reactive phenomena are mainly of connective tissue and may result in the formation of a demarcation zone. (4) In the absence of a demarcation zone a transition zone is constant and indicates destruction of the adjacent parenchyma prior to invasion by carcinoma cells. (5) Propagation of the tumor takes place by infiltration and along perivascular spaces. (6) Reactive phenomena occur in the pia-arachnoid and in the choroid plexus."

Nasopharyngeal Fibroids Treated with Radium; Case Report. Samuel G. Dabney, M.D., Kentucky M. J. 20:461, July, 1922.

A CASE of fibroid of the nasopharynx, removal of which had been twice attempted without success, but with almost exsanguination of the patient, was treated by radium (Dr. D. Y. Keith) with entire atrophy of the growth and complete recovery of the patient.

Radium Therapy in Eye, Ear, Nose and Throat Work. Ricardo Fernandez, M.D., J. Philippine Island M. A. 2:116, June, 1922.

THIS is a report of six cases which included basal cell epithelioma, carcinoma of the throat, sarcoma of the nasopharynx, neurofibroma of the base of the tongue, trachoma, and cataract of both eyes with glaucoma.

These cases are all of about a year's duration, more or less, since treatment was instituted and all have shown improvement since treatment was begun.

The Advantages of Modern Methods of Diagnosis for the Dentist. Thos. B. Hartzell, M.D., D.M.D. Reprint from the Dental Cosmos.

SINCE dentistry has come to occupy the place it now does in the field of internal medicine it is necessary that the dentist have some understanding of medical problems.

It is not practical for him to look forward to attaining a medical degree as an aid to his dental practice since this would entail nine years of professional study, a thing which very few men would undertake, but the conscientious dentist feels his need of medical knowledge and would welcome some practical plan to attain it.

At the University of Minnesota a course of thirty lectures in medicine has been arranged for dental students by means of which they make the acquaintance of the common interlocking diseases which the dentist and physician need jointly to understand. In these lectures focal infection is treated of in relation to general medicine, obstetrics, eye, ear, nose and throat, surgery, nervous and mental diseases, and chronic diseases of the lungs, heart and kidneys.

The writer suggests that certain subjects now taught in the dental schools be made entrance requirements and that certain unessential subjects now taught in dental schools be eliminated from the course to make room for essential medical subjects.

A knowledge of the bacteriology, pathology and clinical treatment of clinical diseases would create a type of man who could and would cooperate with the medical profession in a way now impossible.

The Roentgen Examination of the Gastro-Intestinal Tract. F. H. Baetjer, M.D. Abstracted from Reprint.

THE author treats the subject in comprehensive and condensed detail throughout 20 pages of text accompanied by 40 illustrations. Owing to the teeming detail this abstract is more suggestive than complete.

The percentage of error in the roentgen diagnosis of the gastro-intestinal tract is greater than for any other part of the body. This is so because the tract is subject to many variations and may be affected by many causes, such as mental conditions, drugs, food, and reflex influences from other lesions not directly connected with the tract. Also there is no such thing as a fixed normal. Every patient is a new problem whose variation from a hypothetical normal must be ascertained. All these things lead often to mistakes. Considering that the roentgen diagnosis of gastro-intestinal disease has been in existence only a little more than ten years the progress made is not discouraging but is rather astonishing and each year witnesses further progress in the exactness of this method.

The roentgen interpretation should be made, not by the clinician, but by an independent observer. However, should the roentgen interpretation vary completely from the clinical findings the latter should have more weight in final diagnosis.

Roentgen examination of the gastro-intestinal tract should be made "in all cases where cancer or ulcer is suspected; where there is a long history of digestive disturbance, and particularly in cases over 40 years of age"; the latter group is included because cancer is so common after that age.

Both plate and fluoroscope should be used, as each supplements the other. The same type of meal should be adhered to because variations in this will cause variations in the activity of the stomach. Activity will be affected also accordingly as the stomach is presented fasting or full at the time the meal is given.

The fluoroscope is the better means of studying the esophagus. If the separate swallows of barium tend to run

together then the point of slowing up must be especially studied. This delay will be due to either spasm or to stricture. Evanescent spasm is of no significance but marked dilatation is an important sign. In this form the entire circumference of the esophagus is involved, and will present a V shape with the apex pointing downward toward the center of the lumen. On the other hand, stricture, if it is real, occurs in the wall, and if a lumen is present it will be at one side. In the very young stricture is apt to be the result of a burn but after youth it is generally the sign of carcinoma, or perhaps of a syphilitic lesion which is very difficult to differentiate from carcinoma until after antisyphilitic treatment has been given.

In the stomach, adhesions present the greatest source of error in diagnosis. In the author's experience the error in a series of 1,000 cases was from 20 to 25 per cent. "Very early carcinomatous lesions of the pylorus and lesser curvature cannot be differentiated from those of benign ulcers, while any lesion in the greater curvature is almost invariably malignant."

Roentgen examination is valuable in determining proper functioning after a gastro-enterostomy and also to determine the effect of medical treatment of gastric ulcer. In the latter cases peristalsis should return to normal after healing.

The last half of the original paper deals with the examination of the small intestines, the colon and the appendix. Tuberculous lesions are included in the discussion.

The Rectosigmoid Apparatus. Horace W. Soper, M.D., Am. J. Roentgenol. 9:412, July, 1922.

MAYO says the rectosigmoid apparatus consists "of three and one-half inches of the intestinal tract, which includes the terminal two inches of the sigmoid and the proximal one and one-half inches of the rectum." Next to the stomach and duodenum it is the most frequent site of pathology in the entire gastro-intestinal tract.

Mayo and Hurst, the author states, have both concluded that the rectosigmoid apparatus is a mechanism which retards the fecal current and which prevents the continuous progress of the intestinal contents into the rectum.

The writer's study of both normal and abnormal patients by means of the sigmoidoscope has led him to conclude that only slight traces of fecal matter, if any, remain in the rectum after normal defectation; and that the normal rectosigmoid apparatus includes from two to three inches of the bowel and alternately contracts and dilates at the same time with the respiration; that normal cases have considerable variation in the tonicity of the contracture but that a five-eighths caliber tube can always be passed through it; that normal cases prior to defecation in the morning have the fecal column just above or just engaging the rectosigmoid area and that formation of feces occurs in the iliac colon.

Pathology and treatment are both briefly discussed and it is noted here that Mayo, in 100 consecutive operated cases of cancer of the rectum and the rectosigmoid, found that 63 per cent of the growth involved the rectosigmoid, 30 per cent the rectum only, and 7 per cent the anal canal.

Both fluoroscopic and plate methods are disappointing when used to visualize the rectosigmoid apparatus. "Inconstant and ever-changing anatomic relationships make it impossible to establish normal standards" by this means, and sigmoidoscopy is the only reliable method although the author adds that he has sometimes obtained good views by means of first insufflating bismuth subcarbonate with patient in knee-chest position and afterwards taking the plates with patient in dorsal position.

Numerous illustrations accompany the original.

Editorial. Am. J. Electroth. & Radiol. 40:257, August, 1922.

THIS editorial calls attention to the fact that the ultraviolet rays must not pass through glass if they are to have any therapeutic effect upon the patient. Attention is called to the following quotation from Professor Alfred E. Hess of Columbia University: "I did not realize how little this physical phenomenon is appreciated by physicians until the other day when present at a consultation in which several of the leading consultants of this city took part. These physicians, who must be considered as exceptionally well posted, had been treating a child for weeks with heliotherapy, and were surprised to hear that the treatment must necessarily have been ineffective, and invaluable time lost, in view of the fact that the windows were closed during the treatment."

The Effect of Ultraviolet Rays on the Calcium and Inorganic Phosphate Content of the Blood Serum of Rachitic Infants. Frederick F. Tisdall, M.D., Canad. M. A. J. 12:536, August, 1922.

"EXPOSURE of rachitic infants to ultraviolet rays from a mercury vapour quartz lamp, for very short periods, caused a marked increase in both the calcium and inorganic phosphate content of the blood serum. The increase in the calcium and inorganic phosphate content of the serum was followed by clinical and roentgenographic evidences of healing. No increase in the serum calcium and inorganic phosphate was obtained by prolonged exposure to the rays from an ordinary 500 watt incandescent lamp."

Quartz Light Therapy in Skin Diseases. E. Lawrence Oliver, M.D., Jour. A. M. A. 79:625, August 19, 1922.

THIS paper gives an explanation of the physics of ultraviolet light and sketches the history of its therapeutic use. The author sums up his paper in the following paragraph:

Quartz light is of great value in many ulcers, especially those due to poor circulation. It is of great value in the port wine type of vascular nevus and in alopecia areata. It is often a help in the treatment of psoriasis. In localized chronic eczema with infiltration of the skin, it may prove of great value. In acne vulgaris, though the light is beneficial, improvement is usually only temporary. In lupus vulgaris it is sometimes curative. In lupus erythematosus, it may cause temporary improvement.

In the discussion following the reading of this paper varicose ulcer and pityriasis rosea were added to the list of amenable lesions. It was also stated that roentgenological treatment was far superior to the quartz lamp radiations and applicable in a far wider field. To this latter statement Dr. Oliver replied: "The roentgen rays are more valuable and more cases can be treated successfully with them, but the indications are different, that is, the ultraviolet light may succeed in cases in which roentgen rays are not indicated, and vice versa." Dr. Oliver in closing also mentioned the fact that the patient should be told beforehand if a severe blistering burn was contemplated.

Comparisons Between the Therapeutic, Photographic and Ionization Effects of Ultraviolet and of Beta Radiations. L. H. Clark, B. Sc., *and* B. D. Waters, B. Sc., The Physics Department, Middlesex Hospital. J. Roentgen Soc. 18:119, July, 1922.

"THE main object (of this study) has been to find out whether there is any connection between one bilogical effect of these radiations and two important physical effects to which they

give rise, namely photographic action and ionization."

Exposure of the skin to either of these types of radiation results in effects varying from a faint reddening to ulcer formation. There are also marked differences in the effects of exposure from these two different types of radiations.

A mercury arc, enclosed in a quartz vessel was the source of the ultraviolet radiations used for purposes of comparison in this study. The current was derived from a set of secondary cells from which any potential difference up to 200 volts could be obtained.

"It was found that as the energy consumed by the arc lamp increased, the latent period decreased and the reaction changed from one in which there was only a temporary blushing of the skin to another in which the irradiated skin ultimately peeled from the arm." Under the conditions of the experiment the quantity of radiation received by the skin depended upon the time of exposure and the voltage between the arc terminals. "It would appear that, for a given distance between the skin and the arc lamp, the energy consumed by the latter during any given exposure may serve with fair accuracy to measure the probable extent of the resulting skin reaction. This parallelism between the energy consumption of the arc and the degree of skin reaction resulting from exposure to the radiations of the former is put forward with considerable reserve."

Upon comparison with the effects of the radiations of beta rays it was found that there was a striking difference in the time required for an erythema action to occur. This period was under five minutes in the case of exposure to ultraviolet rays and about seven days in the case of exposure to beta rays. A 24 mgm. capsule of radium bromide with an aluminum screen was used in obtaining the data for comparison. "The duration of the latent period in the case of ultraviolet radiation forms a rough means of estimating the degree of the resulting skin reaction. However, the differences in the latent periods resulting from widely differing exposures to beta rays are too small to be useful in this connection." This marked difference in the latent periods resulting from the two forms of radiation must be considered in arriving at any theory as to the nature of the processes involved in a skin reaction.

Upon the day of exposure to ultraviolet radiation the resultant erythema could be made to disappear by simply stretching the skin irradiated. The next day this revealed a pigmented skin although the red color could be made to disappear. It was also an interesting fact that in ultraviolet light the irradiated skin ceased to fluoresce so strongly as the normal skin and this loss of fluorescence persisted for several months.

The experiments to secure comparisons of the skin reactions with the photographic actions of beta rays and ultraviolet rays led to the following conclusions: "It is clear that the photographic plate, sensitive as it is to the whole gamut of visible and ultraviolet radiations, fails to discriminate between those radiations which excite an erythema reaction and those which are inactive towards the skin * * * the photographic tint method, as practiced in the case of beta ray treatment, is unsuitable as a means of indicating the skin reactions resulting from exposure to sources of ultraviolet radiation.

"As is well known the ionization produced in air by beta rays is the method *par excellence*, for the determination of the therapeutic efficiency of a source of beta radiation. * * * A comparison between the ionization currents due to these two types of radiation shows that the electroscopic effect due to the radiation from 1 sq. cm. of the mercury arc is only 0.75 per cent of that due to the radiation from the same area of the radium source. Hence one may conclude that the ionization in air, caused by radiations from a quartz mercury arc, is negligible."

Experiments upon the photo-electric action of ultraviolet light makes it appear "that in the photo-electric activity of a metal surface under the influence of ultraviolet light we may have a powerful method of measuring the therapeutic effect of these radiations. There is, however, a serious objection to this application of the photo-electric effect. The metal surface is subject to fatigue, the practical effect of which is that electroscopic readings for identical conditions vary with time and with the degree of polish of the metal surface. If the laws governing these variations in activity were known it is possible that objections to the method might be removed. Research in this connection is proceeding at the present time."

A few simple experiments were made upon dried human skin and upon the living subject to determine the photo-electric action of ultraviolet radiations upon the human skin but the connection between the skin reactions and the photo-electric effects is still unsolved.

"It is clear from the comparisons which have been made, that, whereas, there are two important physical methods whereby the activity of beta rays may be determined, there is no accurate method of measuring the therapeutic activity of the ultraviolet radiations from a quartz mercury arc. The method of estimating exposures of the skin to ultraviolet radiation in terms of the energy consumed by the arc during the period of irradiation, which was put forward at the beginning of this paper, is at best only approximate. There is an urgent need therefore for some accurate method of measuring the efficiency of sources of ultraviolet radiation, which are used for clinical purposes."

Violet Ray in the Treatment of Variola. Pasquale Romeo, M.D., Bost. M. & S. J. 187:215, August 10, 1922.

THIS paper describes most remarkable results following upon the use of the ultraviolet ray in three cases of small-pox.

In one particularly severe case, in which the suffering produced by the vesicles was excruciating, immediate relief and comfort followed the initial application (three hours to the whole body), and within twenty-four hours after this treatment a marked improvement in the clinical picture occurred. Treatment was continued for six days, the postule stage was aborted, and practically no marks remained.

Equally satisfactory results followed treatment in two other cases. In these cases three Menin lamps of 110 voltage were placed on a stand so that one lamp radiated the face, chest and arms, another the abdomen and hands, and a third lamp radiated the thighs and feet. The lamps were kept from five to nine inches from the surface of the body accordingly as the patient could bear the heat. The patient turned from side to side as the heat became uncomfortable at this distance and during sleep the lamps were moved farther away. Treatment was given as often as the patient's comfort demanded it.

The writer believes that the earlier the ray is used the shorter will be the course of the disease and the milder the symptoms.

Principles and Practice of X-ray for Diagnosis. John A. Metzger, M.D., Roentgenologist to the School for Graduates of Medicine, Medical Department, University of California, Southern Division, Los Angeles. Octavo, pp. 144, illus. 61. St. Louis, Mo. C. V. Mosby Company, 1922. Cloth, $2.75.

THIS is a comprehensive treatise upon the technique of x-ray photography and makes no pretense of going into the detail of any other phase of roent-

genology. The author states that his "aim in the preparation of this book is to put into the hands of the student and operator a formula on which to base his work in order that he may obtain better results and thus be able to reach a more correct diagnostic interpretation."

The chapter headings are: The Laboratory and Appliances; Stands Tables and Target Adjustment; Standardized Positions; Spine and Pelvis; Clavicle, Scapula, Sternum and Ribs; Technic for the Extremities; Alimentary Canal; Liver, Gall-Bladder and Genitourinary Tract; Stereoscopy and Localization; Dental and Oral Radiography; Developing Room Appliances and Technic.

There are 61 original illustrations and these as well as the typographical appearance of the book are excellent. Its usefulness far exceeds its modest price.